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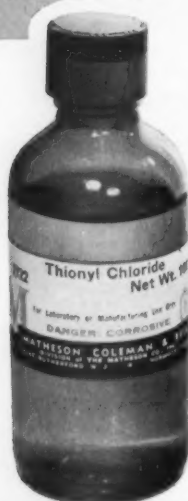
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X-ray Breakage of Lily Chromosomes at First Meiotic Metaphase¹

Helen V. Crouse

Department of Biology, Goucher College, Baltimore, Maryland

THE studies on lily chromosomes described in this article demonstrate that x-rays produce an effect on fully condensed meiotic (first metaphase, M I) chromosomes which is clearly detectable at the first meiotic division (first anaphase, A I), not in the form of chromosomal or chromatid aberrations, but in the form of bridges here interpreted as *half-chromatid bridges*. These studies clarify the anomaly of "potential x-ray breaks" (1) and simplify the interpretation of radiation effects on meiosis reached by Darlington and LaCour (2).

from 15 to 45 sec, depending on dose. Control and irradiated anthers were kept in Bonner's solution until they were fixed.

2) *X-ray treatment.* Unfiltered x-rays (10, 15, and 30 r) were given at 20 in. with a tube operated at 75 kv and 10 ma delivering 40 r/min.

3) *Fixation and cytological study.* Because preliminary study showed that microsporoeytes at M I reached mid-A I after 2 hr at room temperature, anthers for A I analysis were rayed and fixed 2 hr later. For A II analysis following M I irradiation, the

TABLE 1. Microsporoeytes rayed at M I and scored at Mid-A I. Frequency of normal cells and of cells showing acentric chromatid fragments and half-chromatid bridges. No chromatid bridges.

Dose	Slide	Total cells	Total chromosomes	Normal cells	Acentric F	Half-chromatid bridges					Bridges per cell
						1	2	3	4	5	
10	L21-1 = 1	71	852	49	2	16	4	0	0	0	24/71 = 0.33
15	L13-1 = 4	122	1464	74	0	36	10	2	0	0	62/122 = 0.50
15	L28-1 = 1	196	2352	107	1	73	13	2	0	0	105/196 = 0.53
30	L11-1 = 1	74	888	28	0	27	12	6	0	1	74/74 = 1.00
30	L28-2 = 1	276	3312	99	1	110	52	12	2	0	258/276 = 0.93
30	L28-2 = 2	132	1584	36	2 (2)	59	28	4	0	1	132/132 = 1.00

Lilium longiflorum (commercial variety "Croft") was chosen as material for study, not only because of the extraordinary size and structural clarity of its meiotic chromosomes ($n=12$), but also because the excised anthers can be cultured artificially from pachytene through second meiotic anaphase (A II) without showing any microscopically visible adverse effects (3).

The following experimental procedure was used throughout:

1) *Selection and handling of buds.* Each bud was selected tentatively on the basis of its length. The bud was dissected and five of the anthers were floated in Bonner's solution (3). The tip of the sixth anther (all four locules) was smeared in aceto-orcein. If the smear showed meiotic stages no farther advanced than M I, the five remaining anthers were retained: four were irradiated immediately and the fifth was kept as a control. The entire operation of dissecting the bud, smearing an anther, and examining the smear usually took less than 10 min; irradiating the anthers took

anthers had to be cultured 8 to 9 hr. Anthers were fixed in 3:1 Carnoy and smeared in aceto-orcein. All slides were scored by the writer.

Although I have studied the response of various meiotic stages of lily to x-rays, the primary objective of this article is to present the results on sporocytes rayed at M I and examined at A I (Table 1). The data on cells rayed at pachytene (Table 2) are presented only by way of comparison: they provide a striking contrast to the data in Table 1, where no chromatid bridges, practically no acentric chromatid fragments, and numerous *half-chromatid bridges* are encountered.

That such bridges cannot be attributed to general chromosome stickiness induced by the irradiation seems evident from the following facts: (i) M I chromosomes fixed immediately after irradiation at 10, 15, and 30 r show no clumping or stickiness; (ii) within the same irradiated cell, certain chromosomes form bridges, while others undergo perfectly normal anaphase disjunction (Fig. 1); (iii) half-chromatid bridges are formed at A II fully 8 hr, after irradiation; and (iv) the frequency of half-chromatid bridges per cell at A I increases linearly with x-ray dose.

The photomicrograph in Fig. 1 and the camera lucida drawing in Fig. 2 show an A I bridge that is

¹ This work was done in the Laboratory of Prof. J. Herbert Taylor, Department of Botany, Columbia University, during the tenure of a Faculty Fellowship granted by The Fund for the Advancement of Education, 1952-53. I am indebted to Professor Taylor in countless ways.

TABLE 2. Microsporocytes rayed at early pachytene with 30 r and scored at mid-A I. Frequency of normal cells and of cells containing chromatid bridges (B) and acentric chromatid fragments (F). No half-chromatid bridges.

Slide	Total cells	Total chromosomes	Normal cells	1B and 1F	1B and 2FF	1B and 3FF	2BB and 2FF	No B, 1F	No B, 2FF	No B, 3FF
L10-1 = 1	86	1032	58	13	4	0	3	6	1	1
L10-1 = 2	88	1056	55	14	2	1	4	9	2	1

interpreted in this article as a half-chromatid bridge. The chromosome involved has a subterminal centromere and, hence, very unequal arms, labeled in Fig. 2. Eleven tetrads have undergone normal anaphase disjunction; the twelfth has formed a half-chromatid bridge, whose structural detail is shown in the drawing. This bridge is distinctly different from a chromatid bridge in that no acentric fragment is formed. Starting at the centromere, the short and long arms of the "free" monad, lying to the right at the upper pole and to the left at the lower pole, can be readily traced. The half-chromatid exchange has occurred in the other monad approximately midway of the long arm, and only at this point of exchange does the duplicate nature of the chromatid become evident (to show this duplicity the space between the half-chro-

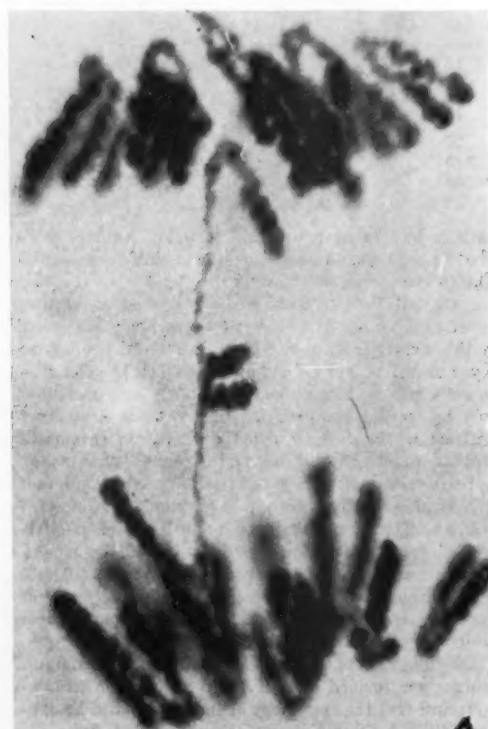


FIG. 1. Chromosomes from an irradiated cell of *Lilium longiflorum*.

matids is slightly exaggerated in the drawing). On this interpretation, meiotic tetrads at M I are really 8-parted—that is, made up of four chromatids, each composed of two half-chromatids. The half-chromatids belonging to different chromatids are capable of reciprocal exchange following x-ray breakage; such exchange leads to bridge formation when the two chromatids in question are taken to opposite poles (either at A I or A II), because the half-chromatids are not yet free to behave as separate mitotic entities.



FIG. 2. Camera lucida drawing of half-chromatid bridge shown in the photomicrograph of Fig. 1.

If half-chromatids undergo such x-ray breakage and exchange, the question arises why *both* half-chromatids comprising the *same* chromatid are not broken more often, thereby producing an acentric chromatid fragment. On a basis of randomness, such fragments should occur 1/7 as often as half-chromatid bridges. Why they do not is a matter of conjecture. Two (and perhaps more) of the acentric fragments recorded in Table 1 (in parentheses) did *not* originate in this manner but were derived from breakage of a half-chromatid bridge at very early A I.

The behavior of the half-chromatid bridges subsequent to mid-A I has been determined by the author, and these studies will be published fully elsewhere. Suffice it to say first, that the half-chromatid bridges may either (i) persist until A II, or (ii) break at two

points, leaving the middle portion of the bridge as a fragment, or (iii) break at one point only, leaving no fragment. These three alternative modes of behavior depend on the location of the half-chromatid exchange in relation to both centromere position and the relative arm lengths of the bivalent. Second, the half-chromatids do not behave as separate mitotic entities at A I or A II. They should do so at the microspore division; and theoretically the sporocytes showing half-chroma-

tid bridges at either A I or A II should give a large proportion of spores with fragments or bridges at the spore division.

References

1. A. H. Sparrow, *Proc. Natl. Acad. Sci.* **30**, 147 (1944).
2. C. D. Darlington and L. F. LaCour, *Heredity* (supplement) **6**, 41 (1953).
3. J. H. Taylor, *Am. J. Botany* **37**, 137 (1950). Also unpublished studies by Taylor and by Helen V. Crouse.

Significance of the Gordon Research Conferences

Emil Ott

Research Department, Hercules Powder Company, Wilmington, Delaware

SINCE this issue of *Science* contains the program of the 1954 Gordon Research Conferences and W. George Parks's editorial with its revealing statistics, a review of the significance of the Gordon Research Conferences to chemical science seems appropriate. The addition this year of a third conference site at Kimball Union Academy, Meriden, N. H., permits further expansion of the impressively rich and varied program. This growth gives pleasure to those who have seen the venture from its cautious beginnings around 1931 at Johns Hopkins University.

Growth of scientific meetings is, however, not always a sign of corresponding increasing value; to the contrary, size and value may not be favorably related from the point of view of scientific gains. In the case of the Gordon Research Conferences, their unique value on the American scientific scene has been maintained in spite of a substantial increase; moreover, the scope has been advantageously enlarged. It may be profitable to describe and analyze some of the factors that have contributed to this favorable picture.

I have been fortunate in being in a position to observe closely the beginning and the maturing of this venture. As my colleague at Johns Hopkins University, Neil E. Gordon revealed to me his hopes, plans, and visions. He felt that something worth while for American science could be accomplished by informal mingling of scientists working in certain fields. Particularly did he feel that the discussion should be concerned with the frontiers aspects. Hence, it would be important to have a recognized leader in the field as chairman for each particular conference. The group would also require discussion leaders or speakers who were concerned with actual advances of scientific work and who would be present by invitation. To these could be added others who, after publication of the program, felt the desire to attend for the purpose of learning and contributing. These additional members would be

carefully screened to keep the group to a productive and creative size, to provide maximum quality and to insure representation of as many laboratories and institutions as possible. Representation from academic, governmental, and industrial institutions, Dr. Gordon felt, should be mixed in suitable manner. Size of a given conference would always have to be limited with emphasis on quality.

Although the main theme would be chemistry, Gordon realized from the beginning that the infusion of neighboring fields, such as physics, mathematics, and biology, would be vital.

With these points in mind, Dr. Gordon started the first experimental conferences on the Homewood Campus of Johns Hopkins University. He felt, however, that a location in the country would be far more ideal. There, the distractions of the city would not exist and the general meetings could be followed by small group discussions, possibly in connection with golf or swimming. He visualized the Gibson Island Club on Chesapeake Bay as a suitable place, and soon the conferences were transferred there.

When Dr. Gordon left Johns Hopkins, the University carried on for a while experimenting with two other locations. Later, Dr. Gordon took over again, establishing eventually a permanent house at Gibson Island. At that time, sponsorship was assumed by the American Association for the Advancement of Science, a logical arrangement which has continued to this day.

Interest in new fields for discussion developed continuously, and, from time to time, the program has been enlarged.

During the formative period, major parts of a mechanism for the perpetuation of the conferences in vital and creative form were developed. Dr. Gordon, as director, felt strongly that each conference should be as autonomous as possible. Although the chairman of a first conference had to be appointed, a system of election by the conference members was soon evolved.

Now, the group elects a vice chairman during the conference sessions. This vice chairman becomes chairman for the next conference, usually in the following year and, with the aid of a program committee, is responsible for the next program. His group is responsible in similar manner for the selection of the conferees. This system seems inherently sound because, after all, each group knows best who is active and qualified.

It soon became apparent that the desirable autonomy of the individual conferences led to certain complications. Scientists are individualists, and, even with the equalizing democratic handling of conference matters, strong individual traits come through. This individualism from time to time leads to apparently pronounced differences of views among the various conferences. Obviously, in order to keep the collection of conferences together, some over-all influence has to be brought to bear, and originally the director provided this factor. As the conferences grew in number, Dr. Gordon and his close advisers deemed it desirable to establish a group that could serve as a sounding board. This group ultimately developed into the Advisory Board, which at first was composed of the director, the chairmen (or vice chairmen) of the individual conferences, the president and secretary of the AAAS, and a representative from each industrial firm that has contributed to a financial plan of the Gordon Research Conferences.

The chairman and vice chairman of a conference are, of course, most vitally concerned with their field of science and provide a fresh and vigorous interest. They change yearly, however, whereas the industrial representatives often bridge a number of years, thus introducing an element of continuity and stability.

The advantages of discussing current important developments in science in congenial groups under ideal surroundings had such appeal that the conferences grew beyond the abilities of Gibson Island facilities to house them. Further, the financial and managerial obligations became extremely burdensome, and Dr. Gordon was forced to relinquish some of the responsibilities. Eventually, the site was moved to Colby Junior College, New London, N. H., with W. George Parks of Rhode Island State College as director. Because Colby had adequate meeting rooms and dormitory facilities, which were unused during the summer months, a profitable symbiosis for both the College and the conferences could be achieved.

Although the Advisory Board continued to be a valuable sounding board, it became apparent that a smaller group was needed to crystallize and to put into action its sentiments and wishes. For this reason, a Management Committee was created through election from the membership of the Advisory Board. The director of the conferences and the secretary of AAAS are also members of this committee. The Management Committee elects its own chairman and is now responsible for formulating and executing, with the director, the policies of the conferences. Naturally, the actions and proposals of the committee are subject to review by the Advisory Board.

During the past year an additional committee has been set up. Known as the Policy Advisory Committee to the Management Committee, it is charged with the responsibility of reviewing and recommending long-term plans and policies. It is hoped that this group will be able to project the role of the conferences into the future course of chemical research as a whole.

It should be realized, however, that these mechanisms are only servants toward a good purpose. The conferences, founded by Neil Gordon and properly named in his honor, are living bodies continuously being rejuvenated. They are meant to serve scientists, and, for this reason, they must be coupled intimately with these men. It is proper that individual conferences select their leaders; it is sensible that the conferences be grouped in a "federation" for over-all advantages. For obvious practical reasons, suitable governing and executive bodies had to be established. Their primary purpose is not to regulate but to serve the advancement of science.

In this spirit, a further provision had to be made in regard to the Advisory Board. A government or academic scientist could be on the Board only by virtue of being the chairman of a conference (or vice chairman substituting for chairman). Because his term is of only 1 year's duration, there is little probability that he will be elected to the Management Committee. This deficiency has been corrected through the admission of members-at-large to the Advisory Board. These members are chosen from government and academic circles and often are named to the Management Committee. Thus, a better balance between academic and industrial interests is obtained for both the Advisory Board and the Management Committee.

The discussions at the conferences are strictly "off-the-record," and no publication may be made of any of the material, except with specific permission of the respective authors. This permits "thinking out loud" and presenting material that otherwise might not be contributed. In particular, it enables the industrial participants to add contributions that would be difficult to release. Today, when the contributions to fundamental science from industry play a considerable role in our scientific endeavor, the interchange between academicians and the men from industry is most vital. There can be no doubt that these conferences have contributed greatly to the cross-fertilization of ideas among various men, various institutions, and various fields of science.

It is desirable that the attendance at the conference extend through the whole period of about 5 days, because only in this manner can the participants become thoroughly acquainted with one another. The presence of some of the wives permits the inclusion of the family circle in this acquaintanceship.

In 1950 the New Hampton School, New Hampton, N. H., was added to the conference site at Colby Junior College. And, in this coming summer, Kimball Union Academy at Meriden, N. H., will be added.

No wonder the informality of operating without a constitution and by-laws has to come to an end! This

spring the Advisory Board will vote on such instruments. Adoption, however, will in no way change the fact that these conferences have been so useful to science because they have been alive and allowed to adapt to conditions. Their friends have nurtured them as living organisms with full awareness of their mission for science.

To reemphasize, it is evident that the Gordon Research Conferences as they exist today have been successful because of: first, very good ideas on the part of the founder and his successors on how such conferences should be run; second, experimentation and development within the framework of the original ideas; and third, an active organization assuring that the improvements of procedures developed in one conference or the disadvantages evident in another were used to improve the conference as a whole.

A basic concept was the recognition that the *conference approach* is the most successful method for creating and spreading ideas as well as promoting the personal contacts on which so much accomplishment depends. To realize this concept, profitable use of the following factors was made: A conference should be held in every important field. The physical arrange-

ments should be agreeable enough so that scientists will attend. The distractions that would keep the scientists from one another's company should be avoided. Topnotch specialists should be invited, yet there should also be present men with more general and practical backgrounds. The meeting should not be too large. Enough time should be allowed for full presentation and discussion of a topic; a full week should be allowed for a field. Discussions should be encouraged by all available means, even at the expense of publication.

In other words, the essence of a conference is stimulation and the interchange of ideas and facts. Gordon Research Conferences are a most outstanding example, because this stimulation and interchange has been promoted without having been burdened with overorganization or allowed to lapse because of lack of attention.

Many deserve thanks for their part in this venture. Some of the names can be found among the directors, conference chairmen, and members of the Management Committee.

A full history entitled *The Gordon Research Conferences* was published in 1950 under the auspices of the AAAS and will be available in revised form in 1955.

Program of the Gordon Research Conferences, AAAS, June 14-Sept. 3, 1954

W. George Parks, Director

University of Rhode Island, Kingston

THE Gordon Research Conferences, sponsored by the American Association for the Advancement of Science, for 1954, will be held from June 14 to Sept. 3 at Colby Junior College, New London, N. H.; New Hampton School, New Hampton, N. H.; and Kimball Union Academy, Meriden, N. H.

Purpose. The conferences were established to stimulate research in universities, research foundations, and industrial laboratories. This purpose is achieved by an informal type of meeting consisting of scheduled lectures and discussion groups. Sufficient time is available to stimulate informal discussions among the members of the conferences. Meetings are held in the morning and in the evening, Monday through Friday, with the exception of Friday evening. The afternoons are available for recreation, reading, resting, or participation in discussion groups as the individual desires. This type of meeting is a valuable means of disseminating information and ideas that otherwise would not be realized through the normal channels of publication and scientific meetings. In addition, scientists in related fields become acquainted, and valuable asso-

ciations are formed that often result in collaboration and cooperative efforts between different laboratories.

It is hoped that each conference will extend the frontiers of science by fostering a free and informal exchange of ideas between persons actively interested in the subjects under discussion. The purpose of the program is not to review the known fields of chemistry but primarily to bring experts up to date on the latest developments, to analyze the significance of these developments, and to provoke suggestions concerning the underlying theories and profitable methods of approach for making new progress.

In order to protect individual rights and to promote discussion, it is an established requirement of each conference that all information presented is not to be used without specific authorization of the individual making the contribution, whether in formal presentation or in discussion. Scientific publications are not prepared as emanating from the conferences.

Registration and reservations. Individuals interested in attending the conferences are requested to send their applications to the director on or before May 15, 1954. Each applicant must state the institu-

tion or company with which he is associated and the type of work in which he is interested. Attendance at each conference is limited to 100.

The director will submit the names of those requesting attendance to the Conference Committee for each conference. This committee will review the names and select the members in an effort to distribute the attendance as widely as possible among the various institutions and laboratories represented. A registration card will be mailed to those selected as soon as possible. Advance registration by mail for each conference is required, and registration is completed on receipt of the card and a deposit of \$25, made payable to the Gordon Research Conferences, AAAS. The deposit of \$25 will cover the registration fee of \$20 (except for academic individuals and students on personal expense who may apply for a reduction of \$10), the balance to be credited against subsistence expenses.

The room rates are as follows: \$2.50 per night per person in a double room with single beds; \$3 per night per person in a single room; \$3.50 per night per person in a single or double room with private bath (the number of rooms available with bath is limited; assignments are made in the order that applications are received). Meals served in the dining room are at the rate of \$6.50 per day per person. Gratuities are provided for by an additional charge of 10 percent, which is added to each bill. Members attending a conference are expected to live at the conference location. If special circumstances warrant living elsewhere, all individuals, including academic members, are required to pay a special registration fee of \$25.

Accommodations are available for a limited number of women to attend each conference, also for wives who wish to accompany their husbands. All such requests should be made at the time of the request for attendance, because these limited accommodations will be assigned in the order that specific requests are received. Children under 12 years of age cannot be accommodated. Rooms are available at several inns and hotels in New London, Meriden, and New Hampton, if reservations are made in advance. Information on these inns and hotels will be supplied by the director on request. No dogs or other animals will be permitted in the dormitories.

Special fund. A special fund is put at the disposal of the chairman of each conference by the Management Committee to assist scientists from academic and government institutions who cannot attend or participate because of financial limitations. This fund is provided with the object of increasing the participation of research workers of academic and government laboratories; it is limited to scientists who have been invited by the chairman to attend a conference in order to present a paper or because it is expected that they will make significant contributions during their stay at the conference. The money is to be used as an assistance fund only and may be used to contribute toward the traveling and/or subsistence expenses at the conference. Total travel and subsistence expenses normally will not be available.

Cancellations. The notice of cancellation must be received in the office of the director three weeks prior to the conference. If such notice is received 3 weeks in advance of the conference, \$20 will be refunded from the \$25 deposit. No refund will be made for cancellations received within the 3-week period.

Requests for attendance at the conferences, or for any additional information, should be addressed to W. George Parks, Director, Department of Chemistry, University of Rhode Island, Kingston, R. I. From June 12 to Sept. 3, 1954, mail should be addressed to Colby Junior College, New London, N. H.

Program at Colby Junior College

CATALYSIS

G. A. Mills, *chairman*; F. G. Ciapetta, *vice chairman*

June 14: A. Schneider and R. M. Kennedy, "Ionic hydrocarbon reactions catalyzed by strong acids"; H. H. Voge, F. T. Eggersten, R. J. Moore, "Iron oxide Catalysts for butylene dehydrogenation"; T. P. Wilson and H. G. Davis, "Influence of inhibitors on the Fischer-Tropsch synthesis."

June 15: C. C. Price, "Formation and reactions of organic hydroperoxides"; D. Turnbull, "Nucleation: phenomena and theory"; R. Gomer, "Chemisorption and mobility of oxygen on tungsten."

June 16: W. P. Hettinger, C. D. Keith, J. L. Gring, and J. W. Teter, "Influence of certain catalyst properties and catalyst poisons on reforming reactions"; H. S. Seelig, T. M. Darby, J. B. Malloy, and R. F. Waters, "Kinetics of ultraforming reactions"; S. W. Weller and S. E. Voltz, "Electric conductivity, catalytic activity, and surface chemistry of chromic oxide."

June 17: P. W. Selwood, "Structure of supported nickel metal"; C. Wagner, "Reactions at the surface of silver sulfide"; T. J. Gray, "Chemical physics of catalysis."

June 18: W. K. Wilmarth, "Mechanism of homogeneous activation of molecular hydrogen."

PETROLEUM

W. J. Coppoe, *chairman*;

Robert F. Marschner, *vice chairman*

June 21, *Fundamental chemistry of certain reactions of hydrocarbons*, Robert L. Burwell, Jr., *chairman*: John E. Willard, "Some reactions of aluminum chloride with Friedel-Crafts reactants"; D. A. McCauley, "General behavior of aromatic hydrocarbons in the presence of boron trifluoride and hydrogen fluoride."

June 22: Herman Pines, "Reaction of terpene hydrocarbons and their application to the chemistry of petroleum hydrocarbons," *Fundamentals of petroleum catalysis*, H. Heinemann, *chairman*: H. F. Mark, "Free radical catalysis: role of free radicals in polymerization"; A. A. Morton and E. J. Lanpher, "Base catalysis: studies with a C¹⁴ Alfin catalyst and its mode of action."

June 23: R. B. Anderson and J. F. Schultz, "Heterogeneous catalysis: chemical and physical changes in iron Fischer-Tropsch catalysts during synthesis"; W. P. Hettinger, C. D. Keith, J. L. Gring, and J. W. Teter, "Heterogeneous catalysis: influence of certain catalyst properties and catalyst poisons on reforming reactions"; I. Wender, H. Sternberg, and H. Greenfield, "Homogeneous catalysis: metal carbonyls and their derivatives as cata-

lysts and intermediates in the reactions of unsaturated hydrocarbons."

June 24, *Physical methods for analysis and research in petroleum chemistry*, L. C. Roess, chairman; L. C. Roess, "Radio frequency spectroscopy"; J. W. Otvos, "Analysis of high molecular weight hydrocarbons."

June 25, *Sulfur and porphyrins in petroleum*, H. M. Smith, chairman; A. H. Corwin, "Chemistry of porphyrins"; H. N. Dunning, "Some properties of porphyrins in petroleum and oil shales"; H. M. Smith, "Recent advances in the chemistry of sulfur compounds in petroleum."

SEPARATION AND PURIFICATION

A. Letcher Jones, chairman;
Arthur Rose, vice chairman

June 28: C. P. Saylor, "The intangible isolation of contaminants within purified substances"; M. R. Penske, "Separation processes in general with emphasis on extraction"; H. G. Drickamer, "Studies in the liquid state."

June 29: H. G. Cassidy, "Paper chromatography"; H. P. Gregor, "Ion-exchange membranes and their industrial utilization"; Karl Kammermeyer, "Membrane separations."

June 30: C. C. DeWitt, "Some physico-chemical aspects of flotation"; Leo Shedlovsky, "Adsorption and fractionation in foams"; R. L. Pigford, "Simultaneous gas absorption and chemical reaction with emphasis on interface resistance."

July 1: C. C. Ward, "Thermal diffusion and chromatography for the separation of sulfur compounds"; W. C. Ferrelus, "Metal chelate compounds."

July 2: Joseph Stewart, "Laboratory studies of continuous processes."

POLYMERS

W. H. Stockmayer, chairman;
R. F. Boyer, vice chairman

July 5-9: H. Mark, "Recent progress in polymer chemistry"; F. A. Bovey, "Fluorochemical elastomers"; F. A. Long, "Diffusion in polymers"; B. H. Zimm, "Relaxation effects in dilute polymer solutions"; F. Bueche, "Interpretation of the visco-elastic behavior of solid polymers"; J. R. Schaefgen and William Kirk, Jr., "Poly-p-xylylene and related polymers"; S. Gratch and J. L. Klee, "Initiation efficiency in free-radical polymerization"; M. Szwarc, "Addition of methyl radicals to aromatic systems"; G. V. Schulz, "Coordination of different methods of molecular weight estimation"; R. C. Osthoff, "Chemistry of silicone polymers"; P. Doty, "Molecular configuration and denaturation of nucleic acid"; P. Debye, "Concentration changes induced by electric fields"; M. K. Phibbs, "Solubility of polar polymers"; W. E. Roseveare, "Thermodynamics of the mechanical properties of oriented crystalline polymers."

TEXTILES

George S. Buck, Jr., chairman;
J. B. Goldberg, vice chairman

July 12: T. F. Cooke, "Mechanism of wrinkle-resistant finishes for cellulosic fabrics"; Herman F. Mark, "Recent developments in the synthetic fiber field in Europe."

July 13: Allan McQuade, "Recent Work on flame resistant treatments for textile fabrics"; R. H. Peters, "Study of the initial stages of the dyeing process."

July 14: C. B. Havens, "Preparation and properties

of fibers from vinylidene chloride"; Alex Brown, "Second-order transition temperature and fiber properties."

July 15: Nils Gralen, "Fiber friction at different velocities"; Herbert G. Lauterbach, "Felts from man-made fibers."

July 16: Newton A. Teixeira, "Theoretical analysis of the mechanism of tongue-tear in woven fabrics."

CORROSION

A. Wachter, chairman;
E. A. Gulbransen, vice chairman

July 19: A. C. Zettlemoyer, "Heterogeneity of surfaces"; C. V. King, "Adsorption of metal salts on metals"; N. Hackerman, "Molecular structure, metal character, and inhibition"; Rudolph Speiser, "Passivation of several metals"; N. Hackerman, "Some experiments in passivity of metals."

July 20: M. J. Pryor, "An interpretation of the significance of the passive potentials on steel"; Morris Cohen, "Electrochemical and surface studies on iron in inhibitor solutions"; C. V. King, "Corrosion inhibition in acid solutions"; H. C. Gatos, "Corrosion inhibitors and polarographic maxima"; Morris Cohen, "Initial consumption of inhibitors on iron"; E. J. Schwoegler, "Functional groups in organic inhibitors."

July 21, *Hydrogen in metals*, J. J. Harwood, chairman; J. J. Harwood, "Effects of hydrogen on mechanical properties of metals"; L. D. McGraw, "Mechanism of hydrogen entry into metals during corrosion processes"; W. R. Heller, "Occlusion of hydrogen in metals"; M. C. Bloom, "Some relations between hydrogen and the corrosion behavior of metals"; *Sulfide corrosion cracking*, J. J. Harwood, chairman; W. D. Robertson, "Mechanism of sulfide corrosion cracking of steels"; A. Wachter, "Cracking of steels in aqueous hydrogen sulfide"; H. H. Uhlig, "Cracking of ferritic stainless steels as related to hydrogen absorption resulting from corrosion."

July 22, *Corrosion at high temperatures*, E. A. Gulbransen, chairman; Carl Wagner, "Solved and unsolved problems in high-temperature oxidation"; Manley W. Mallet, "Oxidation of zirconium and zirconium-tin alloys"; Allan T. Gwathmey, "Rates of formation of oxide films on iron single crystals"; Erwin W. Muller, "Field emission microscopy of high-temperature gas-metal reactions"; A. Taylor, "Oxidation of some iron-nickel alloys"; Donald Thomas, "High-temperature corrosion"; C. E. Birchenall, "Multilayer sealing."

July 23, *Corrosion of 2S aluminum in distilled water at high temperatures*, J. E. Draley, chairman; Maurice Lavigne, "Effects of cold-working on corrosion of aluminum by water at high temperatures"; A. H. Roebuck, "Effect of dissolved oxygen on corrosion of stainless steel in water at elevated temperatures"; D. E. Thomas, "Corrosion of zirconium in water at high temperature."

INSTRUMENTATION

Ralph H. Munch, chairman;
Robert H. Osborn, vice chairman

July 26: Britton Chance, "Biophysical instrumentation"; George McKnight, "Application of the frequency response technique to chemical processes."

July 27: J. W. Beams, "Production and use of high centrifugal fields"; W. J. Youden, "Statistical design as an aid to improving the precision of instruments."

July 28: H. M. Paynter, "Practical computation of nonlinear control problems"; H. R. Hegbar, "Electronic analog computers and data handling."

July 29: Peter Elias, "Information theory"; N. B. Nichols, "Recent developments in transistors."

July 30: H. F. Schwede, "Oil well logging techniques"; W. H. Howe, "Present status of high-pressure measurements."

Additional papers to be presented during the week: W. G. Sykes, "Some problems in the construction of a streak camera for the photography of explosives"; Paul Hoell, "Use of electronic potentiometers in research"; K. S. Lion, "Recent advances in a method of increasing photographic sensitivity by electric discharges"; J. A. Hrones, "New valve actuator"; T. D. Sharples, "Universal recording balance"; J. C. Hosken, "Automatic read-out for a densitometer"; A. H. Peterson and L. F. Marinaccio, "Adapter for recording 60-cycle wave forms on ordinary recording potentiometers"; A. H. Peterson and Victor Jackman, "Precise determination of humidity by a titration method"; Marcus O'Day, "Measurement of total radiation by the pressure exerted on a polished diaphragm"; C. W. Miller, "New transducer for converting shaft rotation to voltage"; J. M. Devine, "New instruments for the measurement of pressure, temperature, and weight"; I. Lefkowitz, "Computer control of a batch chemical process"; B. S. Benson, "New semi-automatic measuring device, or cybernetics rampant"; R. R. Webster, "Improved null balance method for x-ray measurements"; R. H. Munch, "Instrumentation for vapor phase partition chromatography"; R. H. Munch, "Simple instrumentation for measuring thermal stability"; David R. Simonsen, "Infra-red analyzers as monitors for toxic solvent vapors"; D. R. Conlon, "Recording dilatometer for polymerization studies"; D. Z. Robinson, "Hydrogen-deuterium analysis with a Fabry-Perot interferometer"; Raymond Jonnard, "Some experiments on optical reimagining and applications."

ELASTOMERS

John Rehner, Jr., chairman;
A. M. Bueche, vice chairman

Aug. 2, *Fluorine-containing elastomers*: J. F. Abere and P. J. Stedry, "1,1-Dihydroperfluorobutyl polyacrylate: vulcanization and properties"; E. T. McBee, "Fluorine-containing silicones as intermediates for synthetic rubber"; F. J. Honn, "Preparation and properties of fluorinated elastomers."

Aug. 3, *Special techniques in elastomer research and development*: D. L. Loughborough and J. W. Born, "Radioactive techniques applied to tire wear"; W. R. Smith, "Examination of carbon black and reinforced elastomers with the electron microscope"; Norbert J. Scully and William Chorney, "Biosynthesis of C¹⁴-labeled rubber, and carbon assimilation and turnover in *Hevea brasiliensis*."

Aug. 4, *Abrasion*: C. S. Wilkinson, Jr. and S. D. Gehman, "Abrasion of rubber"; G. Kraus, J. F. Svetlik, and H. E. Railsback, "Relation of some carbon black properties to abrasion and reinforcement"; E. M. Dannenberg and B. B. S. T. Boonstra, "Effect of coefficient of friction on the rate of abrasion of rubber compounds."

Aug. 5, *Vulcanization and elastomer structure*: F. P. Baldwin and R. L. Anthony, "Experimental examination of the statistical theory of rubber elasticity"; H. P. Brown and C. F. Gibbs, "Carboxylic elastomers and their vulcanizates"; P. A. Goodwin, "Electron-irradiated polyethylene."

Aug. 6, *Attack by microorganisms*: J. T. Blake, D. W.

Kitchin, and O. S. Pratt, "Action of soil microorganisms on rubber insulation."

FOOD AND NUTRITION

Hartley W. Howard, chairman;
Anthony A. Albanese, vice chairman

Aug. 9, *Obesity*: Margaret W. Bates and J. Mayer, "Multiple etiology of obesity"; Sidney C. Werner, "Controlled study of weight reduction on two isocaloric regimens of different protein content"; A. W. Pennington, Discussion. G. R. Tristram, "Production of protein foodstuffs in the United Kingdom."

Aug. 10, *Agricultural practices and nutritional quality of crops*: G. E. Hilbert, "Complexity of chemical composition of foods"; Kenneth C. Beeson, "Locational factors affecting the nutritional quality of food and feed crops"; C. Warren Thornthwaite, "Timing crop production to assure maturity"; George L. McNew, "Pesticide contamination of food products."

Aug. 11: Edwin Traisman and James Ingle, "Technical advances in cheese production and distribution"; Fred A. Kummerow, "Nutritional value of polymerized fats." *Evaluation of nutritional states*: James B. Allison, "Biochemical analysis of nutritional states"; Albert R. Behnke, "Lean body mass and nutritional states."

Aug. 12: Ancel Keys or Josef Brozek, "Evaluation of relative obesity and caloric status"; J. D. Boyd, "Nutritional states with particular reference to body-weight-height charts"; Roger J. Williams, "Biochemical individuality and nutritional state."

Aug. 13, *Dextran and methylcellulose gums*: Robert C. Hockett, Introductory remarks; C. E. Rist, "Dextran—a new class of gums"; G. K. Greminger, Jr., "Methylcellulose—a Synthetic cellulose gum."

VITAMINS AND METABOLISM

Grace A. Goldsmith, Chairman;
P. L. Day, Vice Chairman

Aug. 16: G. E. Cartwright, "Copper and its role in erythropoiesis"; O. Neal Miller, "Intrinsic factor studies"; W. A. Wood, "Interaction between para-aminobenzoate and pantothenate for the growth of *B. linens*"; J. Baddiley, "Chemistry of Coenzyme A"; Esmond E. Snell, Discussion.

Aug. 17: H. R. V. Arnstein, "Effect of vitamin B₁₂ on methyl group synthesis"; C. G. Mackenzie, H. J. Sallach, and W. R. Frisell, "A one-carbon cycle and active formaldehyde"; G. R. Greenberg, "Biosynthesis of purines"; H. R. Mahler, "Metallo-flavo proteins and electron transport."

Aug. 18: J. Beaton and E. W. McHenry, "Vitamin-B₆ deficiency in experimental animals"; Charles D. May, "Vitamin B₆ nutrition in infancy"; Klaus Schwarz, "Factor 3 and dietary necrotic liver degeneration: its metabolic and nutritional significance"; Johannes Moustgaard, "Influence of the B vitamins on metabolism in swine"; R. W. Luecke, "B vitamins in the nutrition of the baby pig."

Aug. 19: R. T. Holman, "Essential fatty acid metabolism"; R. G. Langdon, "Cholesterol synthesis"; Robert Becker, "Ascorbic-acid deficiencies in relation to cholesterol metabolism"; A. Tamplin, "Metabolic interrelationships of lipoproteins, with special reference to human athero-sclerosis."

Aug. 20: R. G. Tucker, "Effects of various levels of dietary sodium chloride in the albino rat"; W. S. Hart-

roft, "Relationships of choline to vascular diseases in experimental animals"; A. C. Coreoran, "Nutritional factors in human hypertension."

MEDICINAL CHEMISTRY

Karl H. Brunings, chairman;
Karl H. Beyer, vice chairman

Aug. 23, *Hypertension session, Cardiovascular section*: A. C. Coreoran, "Physiological basis of hypertension"; Speaker to be announced, "Chemistry of Veratrum alkaloids"; E. Schlitter, "Chemistry of Rauwolfia alkaloids"; Jacob W. Stutzman, "Pharmacology of Rauwolfia and Veratrum alkaloids."

Aug. 24, *Hypertension session, Renal and Electrolyte Section*: Karl H. Beyer, "Fundamentals of renal pharmacology"; Robert Gaunt, "Hormonal regulation of salt and water metabolism"; Tomas H. Maren, "Sodium diuretics, with particular reference to carbonic anhydrase inhibitors"; Sibley W. Hoobler, "Current therapy of hypertension."

Aug. 25, *Microbiological session*: Ernest Jawetz, "Combined antibiotic action in theory and practice"; D. K. Detweiler, "Veterinary problems in chemotherapy"; W. Celmer and I. A. Solomons, "Structure and chemistry of thiolutin"; Speaker to be announced, "Structure and chemistry of other antibiotics."

Aug. 26, *Cancer chemotherapy session*: Van R. Potter, "Current biochemical studies in oncology"; Hilary Koprowski, "Oncolytic action of viruses"; Howard E. Skipper, "Theoretical and empiric contributions to cancer and chemotherapy"; David A. Karnofsky, "Problems and trends in clinical cancer chemotherapy."

Aug. 27, *Visceral anticholinergic session*: W. D. M. Paton, "Pharmacological basis for anticholinergic therapy"; Robert B. Moffett, "Chemistry of visceral anticholinergic agents."

CANCER

Albert Tannenbaum, chairman;
Jacob Furth, vice chairman

Aug. 30, *Fifty years of cancer research: Symposium on environmental factors in the causation of cancer.*

Aug. 31, *Symposium on cancer in man*: "Natural history of the disease"; J. Englebert Dunphy, "Changing concepts in the surgery of cancer"; "Outlooks in radiation therapy"; Sidney Farber, "Current status and potential of cancer chemotherapy."

Sept. 1, H. Demeree, Walter J. Burdette, and Walter E. Heston, *Symposium on mutagenesis and carcinogenesis*; Charles Berman, "Primary carcinoma of the liver"; I. Berenblum, "Some factors influencing gastric carcinogenesis in the mouse."

Sept. 2, Theodore S. Hauschka, "Analysis of the cellular components of ascites tumors"; Joseph Leighton, "Growth pattern of some normal and cancerous tissues in sponge matrix tissue culture"; Raymond E. Zirkle and William Bloom, "Effects of irradiating parts of single dividing cells"; Glenn H. Algire, "Advances in transparent chamber techniques."

Sept. 3, Irving Zeidman, "Experimental studies on the invasion and spread of tumors."

Program at New Hampton School

AROMATIC CHEMICALS

Webster N. Jones, chairman;
Robert B. Carlin, vice chairman

June 14: Emil Ott, "Oxidation of aromatic chemicals"; A. V. Willet, "Present important aromatic chemicals"; F. S. J. Swackhamer, "Epoxy resins."

June 15: L. Marek, "Petroleum sources of aromatic chemicals"; E. E. Donath, "Aromatic chemicals from coal"; Henry F. Smyth, Jr., "Toxicity of aromatic chemicals"; Per K. Krolich, "Medicinal aromatic chemicals."

June 16: J. E. Jansen, "Aromatic chemicals in elastomers"; J. H. Harshaw, "Aromatic chemicals for scintillation counters"; D. S. Tarbell, "Tropolones and related compounds"; Oliver DeGarmo, "Relation of structure to effectiveness in agricultural insecticides and herbicides."

June 17: R. C. Fuson, "Conjugated additions of Grignard reagents to aromatic ketones"; L. E. Miller, "Directive influence of the methoxy and acetylamino groups on succinylation of substituted naphthalenes"; Gustav Egloff, "Future of aromatic chemicals."

June 18: E. E. Kimmel, "Synthesis of phthalic anhydride"; Donald Bowman, "Halogenated aromatic chemicals."

INORGANIC CHEMISTRY

J. J. Katz, chairman; F. Basolo, vice chairman

June 21-25, *Behavior of inorganic salts in organic solvents*: Leonard I. Katzin, Introductory remarks; Harold L. Friedman, "Solubility of electrolytes in organic solvents"; John L. Huston, "Solute-solvent interactions as shown by isotope-exchange studies"; Herbert C. Brown, "Interaction of metal halides with alkyl halides and with aromatic hydrocarbons"; D. F. Peppard, "Behavior of salts in tributyl phosphate"; D. D. Eley and W. F. Luder, subject to be announced.

Early chemical history of the earth, with special reference to the origin of life: Harold C. Urey.

Molecular addition compounds: Harry H. Sisler, "Addition compounds of dinitrogen tetroxide and chromic oxide with ethers and amines"; A. W. Laubengayer, "Molecular addition compounds of halides of boron, gallium, titanium, germanium, and tin"; C. C. Addison, "Recent developments in dinitrogen tetroxide chemistry"; A. B. Garrett, subject to be announced.

NUCLEAR CHEMISTRY

G. Friedlander, chairman;
T. P. Kohman, vice chairman

June 28, *Nuclear structure and radioactivity.*

June 29, *Nuclear reactions at very high energies.*

June 30, *Nuclear geochemistry and cosmochemistry.*

July 1, *Techniques of absolute counting.*

July 2, *Interactions between nuclei and their environment.*

RADIATION CHEMISTRY

A. O. Allen, chairman; Edwin J. Hart, vice chairman

July 5, A. O. Allen, chairman: Jerome Weiss, "Chemical dosimetry." John E. Willard, chairman: Willard F. Libby, A. C. Schrodt, and Richard L. Wolfgang, "Chemical effects of nuclear transformations."

July 6, Max S. Matheson, *chairman*: Robert L. Platzman, John L. Magee, and Robert H. Schuler, "Physical and chemical aspects of the radiolysis of liquids." Robert Mesrobian, *chairman*: A. Charlesby, Elliott J. Lawton, and O. Sisman, "Modification of polymers by irradiation."

July 7, S. C. Lind, *chairman*: Philip S. Rudolph, Leon M. Dorfman, and Benjamin P. Burt, "Radiation chemistry in the gas phase." Edwin J. Hart, *chairman*: Thomas J. Sworski, Harold A. Schwarz, and Max S. Matheson, "Radiation effects in water and ice."

July 8, A. O. Allen, *chairman*: Joseph Weiss, Warren M. Garrison, and Sheffield Gordon, "Radiolysis of aqueous solutions." Elmer L. Gaden, *chairman*: Bruce H. Morgan, Charles G. King, and Robert R. Becker, "Chemical changes in irradiated foods."

July 9, S. C. Lind, *chairman*: E. P. Schoch and Milton Burton, "Chemical reactions in the electric discharge."

ORGANIC COATINGS

Lehman E. Hoag, *chairman*;
Louis A. Melsheimer, *vice chairman*

July 12: Introductory remarks; R. B. Seymour, "Coatings from the furans"; R. D. Emmick, "Formulation and properties of polyvinyl acetate emulsion paints"; Harry Burrell, "Application of the solubility parameter concept to film-forming materials."

July 13: R. Buchdahl, "Correlation of film properties with composition"; James A. Shotton, "Coatings from butadiene polymers."

July 14: R. B. Brand, "Organic coatings for cathodically protected metals"; J. H. Saunders or Herbert L. Heiss, "Coatings from the polyurethanes and related polymers."

July 15: Q. P. Cole, "Effect of irradiation on polyethylene coatings"; Turner Alfrey or John Vanderhoff, "Fundamental properties of polymer latices"; S. M. Skinner, "Some electric and thermodynamic factors related to the adhesion of organic coatings."

July 16: S. Gusman, "Some fundamental studies into the durability of baked synthetic enamels."

ION EXCHANGE

J. Schubert, *chairman*;
D. R. Lewis, *vice chairman*

July 19: H. G. Cassidy, "Electron exchange resins"; H. P. Gregor, "Specific ion-exchange resins"; E. Glueckauf, "Improvements in column performance"; H. C. Thomas, "Kinetics and equilibrium behavior of inorganic ion exchangers."

July 20, Round table discussion on ion-exchange equilibria, T. F. Young, *moderator*, G. E. Boyd, A. W. Davidson, E. Glueckauf, H. P. Gregor, K. A. Kraus, G. Scatchard, *participants*. O. Samuelson, "New separations with anion-exchange resins"; H. F. Walton, "Anion-exchange separations of organic mercury compounds"; W. Rieman, III, "Ion-exchange chromatography and polyelectrolyte fractionation."

July 21: G. E. Boyd, "Rate processes in ion exchangers"; F. T. Wall, "Relationships between polyelectrolytes and ion exchange"; T. L. Hill, "Statistical mechanical models of ion-exchange resins"; C. H. W. Hirs, H. A. Sober, E. A. Peterson, and H. C. Isliker, "Interactions of ion exchangers with proteins, enzymes, viruses, and antibodies."

July 22: K. Sollner, "Electrochemistry of ion exchangers"; K. S. Spiegler and M. R. J. Wyllie, "Electroosmotic water transport and desalting by high pressures"; W. R. Walters, "Radioactive waste treatment by electromigration through ion-exchange membranes." *Ion exchange as a tool for studies of electrolyte solutions*: R. M. Diamond, "Behavior of rare earths and transuranium ions"; I. Feldman, T. Y. Toribara, and J. R. Havill, "Ion-exchange studies on the beryllium-citrate system"; H. F. Walton, "Stability of metal amine complexes."

July 23: D. C. Grahame, "Specificity of ionic adsorption at a metal-solution interface."

STATISTICS IN CHEMISTRY

Cuthbert Daniel, *chairman*

July 26, General introduction to statistical design of experiments, W. A. Noyes, *chairman*: H. O. Hartley, "Example of fundamental ideas (orthogonalization, randomization, and blocking)." J. W. Hopkins, *chairman*: W. J. Youden, "Designs for the chemist's qualitative problems (factorials, linked blocks, etc.)."

July 27, Components of variance, G. Wernimont, *chairman*: S. L. Crump, "What is a variance component? (General linear model, urn sampling, design of components of variance experiments)." E. L. LeClerc, *chairman*: S. M. Free, "Examples (material sampling, optimum allocation, interlaboratory tests)."

July 28, Designs for the chemist's quantitative problems, G. Symonds, *chairman*: G. E. Kimball, "Designs of first order, fitting response surfaces." J. C. Whitwell, *chairman*: J. S. Hunter, "Seeking for an optimum."

July 29, Multiple comparisons and multiple decisions, G. Calingnert, *chairman*: R. F. Link, "Multiple comparisons (confidence intervals, allowances, and error rates)." G. E. Kimball, *chairman*: R. E. Bechhofer, "Multiple decisions (choosing the best of several, comparisons with a standard)."

July 30, Review discussion.

CHEMISTRY OF STEROIDS AND RELATED

NATURAL PRODUCTS

Carl Djefassi, *chairman*;

L. H. Sarett and R. B. Turner, *vice chairmen*

Aug. 2: M. E. Wall, C. R. Eddy, and S. Serota, "Stereochemistry of steroidal sapogenin side chains"; A. L. Wilds, "Steroid syntheses"; W. S. Knowles, "Studies on the total synthesis of steroids"; G. Stork, subject to be announced.

Aug. 3: T. G. Halsall, "Stereochemistry of polyporenic acid C"; F. S. Spring, "Some recent experiments in the triterpenoid group"; A. Robertson, "Triterpene acids and related compounds from molds"; E. R. H. Jones, subject to be announced.

Aug. 4: A. Eschenmoser, "Contribution to the synthesis of terpenoid alicyclic compounds"; A. J. Birch, "Hydroaromatic steroid hormones"; A. Zaffaroni, "Recent investigations in steroid biochemistry in Mexico"; A. Wettstein, "Advances in the field of adrenal cortical hormones."

Aug. 5: J. W. Cornforth, "Biosynthesis of cholesterol"; K. Bloch, "Biosynthesis of steroids"; R. B. Woodward, "Some recent advances in the chemistry of natural products."

Aug. 6: D. Ginsburg, "Total synthesis of morphine"; G. Laubach, "Reactions of steroidal peroxides."

ANALYTIC CHEMISTRY

L. B. Rogers, *chairman*;

Harold A. Frediani, *vice chairman*

Aug. 9: E. W. Balis, "Analytic chemistry—content, practice, and training"; W. H. Baldwin, "Distribution of inorganic materials between immiscible liquids. Structural relationships among organic solvents."

Aug. 10: R. B. Fischer, "Physical forms of analytic precipitates"; J. A. Marinsky, "Ion-exchange membranes."

Aug. 11: W. Ulrich, "Analysis of carbonate minerals by infra-red absorption and x-ray diffraction"; N. B. Hannay, "Analysis of solids with the mass spectrograph."

Aug. 12: C. N. Reiley, "Chronopotentiometry"; C. J. Borkowski, "Measurement of radioactivity"; W. W. Meinke, "Activation analysis."

Aug. 13: J. N. Shoolery, "Nuclear resonance."

CHEMISTRY AND PHYSICS OF METALS

G. J. Dienes, *chairman*; J. C. Fisher, *vice chairman*

Mechanical properties of metals

Aug. 16: H. Brooks, "Electronic theory of cohesion and elastic constants"; C. Wert, "Anelasticity of metals"; J. R. Low, "Microstructure and fracture"; E. W. Hart, "Role of dislocations in plastic deformation"; B. E. Warren, "X-ray measurements of cold-work distortion"; M. Bever, "Stored energy."

Aug. 17: E. Parker, "Work hardening and substructure"; J. Washburn, "Work hardening and substructure"; R. W. Cahm, "Mechanical twinning"; H. B. Huntington, "Variation of elastic constants with temperature and pressure"; R. W. Powers, "Internal friction due to impurities."

Aug. 18: E. Montroll, "Frequency spectrum of vibrations of crystal lattices"; A. Nowick, "Internal friction effects produced by dislocations"; L. Zernow, "Plastic deformation and fracture at very high strain rates"; T. H. Blewitt and R. R. Coltmann, "Deformation of copper single crystals"; C. E. Dixon, "Low-temperature irradiation and plastic deformation"; R. H. Pry, "Electric resistivity."

Aug. 19: J. H. Koehler, "On the production of vacancies and interstitials during cold work"; J. J. Gilman, "Cooperative dislocation motion"; F. C. Frank, "Dislocation in real crystals"; K. Lüke, "Strain hardening in face-centered cubic metals."

Aug. 20: R. Truell, "Use of ultrasonics in the study of solid-state problems"; T. Vreeland, D. S. Wood, and D. S. Clark, "Delay time in yielding"; R. Smoluchowski, "Structure of grain boundaries."

COAL

M. A. Elliott, *chairman*; Everett Gorin, *vice chairman*

Aug. 23, *Origin of coal*, Irving A. Breger, *chairman*: J. M. Schopf, "Paleobotanical aspects of the origin of coal"; J. H. Quastel, "Metabolism in the soil with special reference to humic acid substances"; Elso Barghoorn, "Degradation of plant tissues in relation to the origin of coal"; W. H. Bradley, "Paleolimnology and the preservation of organic matter."

Aug. 24, *Structure of coal, carbons, and derived products from physical measurements*, J. W. Gartland, *chairman*: J. T. McCartney, "Reflectance measurements";

R. A. Friedel, "Infra-red spectra"; E. W. Toor, "Magnetometric methods"; R. E. Franklin, "Fine structure of carbon."

Aug. 25, *Application of statistical procedures to problems in coal research*, H. H. Lowry, *chairman*: W. S. Connor, Jr., "Statistical procedures"; Speaker to be announced, "Chemical structure of coal and derived products"; S. Ergun, "Gasification reactions"; C. W. Sheldrake, Jr., "Evaluation of coke."

Aug. 26, *Minor atoms and trace elements*, H. C. Howard, *chairman*: A. R. Powell and G. R. Yohe, "Sulfur, oxygen, and nitrogen"; Maurice Deul and J. W. Myers, "Trace elements."

Aug. 27, *Round table discussion of trends in coal research*, H. H. Storeh, *chairman*.

PROTEINS AND NUCLEIC ACIDS

Gerhardt Schmidt, *chairman*;

J. P. Greenstein, *vice chairman*

Biosynthesis with reference to proteins and nucleic acids

Aug. 30, *Possible precursors and intermediaries of nucleic acid biosynthesis*: D. M. Brown, "Chemistry of nucleotides"; Discussion: R. L. Sinsheimer, "Degradation products of DNA"; Van R. Potter, L. Hecht, and R. B. Hurlburt, "Tissue nucleotides"; Discussion: Z. Dische, E. Volkin, "Amino acid supply of cells and tissues." H. E. Umbarger, "Influence of mutual proportions of amino acids on the growth of microorganisms"; Bernard Davis, Discussion; H. N. Christensen, "Concentrative uptake of amino acids by cells."

Aug. 31, *Enzymes involved in nucleic acid formation*: William Shive, "Formation of purines in microorganisms"; John M. Buchanan, "Enzymatic formation of the purine ring"; G. R. Greenberg, Discussion; G. Tonnesen and E. Usdin, "Folic acid activity of blood"; I. Lieberman and A. Kornberg, "Enzymatic formation of pyrimidines"; H. M. Kalekar, "Formation of the bonds between purines and carbohydrate groups"; S. P. Colowick, N. O. Kaplan, and M. Friedkin, Discussion; *Some enzymes involved in peptide bond formation*: G. Brawerman and E. Chargaff, "Formation of bonds between carbohydrate and phosphoryl groups of nucleotides"; Leon A. Heppel, Discussion; W. Maas, "Enzymatic formation of the peptide bond in pantothenic acid"; H. J. Strecker and H. Waelsch, "Thio esters of amino acids in enzymatic transfer reactions."

Sept. 1, *Incorporation studies on intact tissues*: George B. Brown, "Incorporation of labeled precursors into the nucleic acid of cells and tissues"; John Totter, P. M. Roll, A. Bendich, L. F. Cavalieri, Francis Crick, Discussion; C. B. Anfinsen, "Incorporation of labeled amino acids into proteins in animals"; Discussion: P. Zamecnik, M. Simpson, "Incorporation of labeled amino acids in some enzymes and hormone proteins"; D. Steinberg; T. S. Work, "Biosynthesis of milk proteins in lactating mammary glands"; F. W. Putnam, Synthesis of plasma proteins and Bence Jones protein in patients with multiple myeloma"; P. Zamecnik, Discussion; F. Haurowitz, "Biosynthesis of immune proteins."

Sept. 2, *Nucleic acid and protein biosynthesis in bacteriophages and microorganisms*: A. D. Hershey, "Nucleic acid economy in bacteria infected with bacteriophage"; Discussion: F. W. Putnam, "Present status of our information regarding protein synthesis in bacteria infected with bacteriophage"; Barry Commoner, "Studies on the biosynthesis of tobacco virus." *Antimetabolites of nucleic*

acid metabolism: G. B. Hitchings, "Antimetabolites in nucleic acid biosynthesis"; J. A. Stekol, "Mechanism of antimetabolic action of ethionine"; F. Schlenk and G. Schmidt, Discussion.

Sept. 3, Nucleic acid and protein biosynthesis in bacteriophages and microorganisms: Sol Spiegelman, "Adaptive enzyme formation"; B. Magasanik, "Factors Controlling the Rate of Adaptive Enzyme Formation."

Program at Kimball Union Academy

STREAM SANITATION

R. D. Hoak, chairman

June 21: James B. Lackey, "Stream biology"; Ruth M. Patrick, "Physical factors in self-purification."

June 22: Clair N. Sawyer, "Deoxygenation and reoxygenation"; Henry C. Marks, "Disinfection."

June 23: H. Heukelekian, "Basic principles of waste treatment"; Robert S. Ingols, "Toxicity."

June 24: Frank M. Middleton, "Tastes and odors"; C. C. Ruchhoft, "Analytical methods and quality criteria."

June 25: Leslie A. Chambers, "Special topics."

ADHESION

John E. Rutzler, Jr., chairman;

Frank W. Reinhart, vice chairman

June 28, General theory of adhesion, R. F. Blomquist, leader: F. O. Rice, "Mechanism of interaction at surfaces"; M. R. Hatfield and G. B. Rathmann, Application of absolute rate theory to adhesion"; F. W. Reinhart, "Origins of stresses on adhesive bonds."

June 29, Thermodynamics and structures of surfaces, D. M. Gans, leader: Fred Schulman, "Surface factors in cohesion and adhesion"; R. S. Hansen, "Some general aspects of surface thermodynamics."

June 30, Electric phenomena in adhesion and cohesion, L. P. Smith, leader: C. G. B. Garrett, "Potentials and space-charge double layers at interfaces between conductors and semiconductors"; S. M. Skinner, "Transient electric potential associated with breaking structural adhesive bonds"; D. M. Alstadt and H. C. O'Brien, "Galvanic decay of adhesive bonds."

July 1: J. E. Rutzler, Jr., "Effects of stress and strain in adhesive bonds upon dielectric loss factor." Mechanics of Joints, G. W. Koehn, leader: J. L. Lubkin, "Stress distribution in adhesive joints, including tubular and scarf configurations."

July 2: H. A. Perry, Jr., "The strength of adhesive butt joints."

EXTRACTIVE METALLURGY AND MINERAL PREPARATION

Nathaniel Arbiter, chairman

July 5: Speaker to be announced, "Surface energy of solids"; Speaker to be announced, "Potentials at the mineral water interface."

July 6: P. L. DeBruyn and R. Schumann, "Significance of the contact angle in flotation"; N. Arbiter, "Adsorption of inorganic ions by inorganic solids."

July 7: A. M. Gaudin, "Interaction between collectors and minerals"; J. Schulman, "Role of frothers in flotation."

July 8: H. R. Spedden, "Mechanism of particle bubble contact"; T. M. Morris and R. Schumann, "Flotation kinetics."

July 9: Summary Session.

SOLID-STATE REACTIONS IN CERAMICS

W. J. Smothers, chairman

July 12: Samuel Zerfoss, "Influence of trace impurities on solid-state reactions"; H. H. Hausner, "Effect of pressure on some solid-state reactions"; P. A. Marshall, Jr., "Atomistic approach to diffusion processes in solid-state reactions"; J. A. Hedvall, "Sintering and the influence of dissolved gases on the surface activity"; F. Sandford, subject to be announced.

July 13: W. E. Eitel, "Role of volatile constituents in solid-state reactions"; P. Schwartzkopf and W. J. Leszynski, "Sintering mechanism of cermet materials"; G. Cohn, "Experimental methods employed in the investigation of kinetics and mechanism of solid-state reactions"; T. J. Gray, "Chemical physics of oxides."

July 14: J. R. Johnson, "Some observations on sintering of thorium and uranium oxides"; D. L. Heath, "Mathematical analysis of phase diagrams"; R. S. Weisz, "Solid-state reactions and properties of ferromagnetic spinels"; W. F. Sullivan, "Formation of spinels at low temperatures"; E. J. Smoke, "Solid-state reactions in some lithium aluminosilicate ceramics."

July 15: M. C. Wittels, "Radiation damage studies of some refractory crystals"; V. D. Frechette, "Use of the microscope for study of solid-state reactions"; R. W. Grimshaw, "Differential thermal analysis and its applications in the study of solid-state reactions"; N. F. Tsang, "Heat conduction theory in differential thermal analysis."

July 16: G. W. Brindley, "X-ray study of clay minerals and of their thermal transformation"; F. A. Maurer, "Thermogravimetric and x-ray diffraction studies at the National Bureau of Standards"; M. D. Beals, "Observation of solid-state reactions by x-ray methods."

STRUCTURE, CHEMISTRY, AND PHYSIOLOGY OF BONES AND TEETH

Felix Bronner, chairman; William F. Neuman and Reidar F. Sognaas, co-chairmen

July 19, Matrix formation in bones and teeth, C. Leblond, chairman: F. L. Losee and W. C. Hess, "Organic components of dentin matrix"; R. E. Clegg, "Carbohydrates of bone and dentin matrix"; D. D. Dziewiatkowski, "Incorporation of radioactive elements into bone and dentin matrix." F. McLean, chairman: R. M. Amprino, "Bone structural renewal"; J. Gross, "Collagen fibrogenesis."

July 20, Chemistry of mineralization, H. C. Hodge, chairman: V. DiStefano, "Role of phosphatase"; B. B. Migoczsky, "Isotope studies"; A. E. Sobel, "Local factor in calcification." A. B. Gutam, chairman: W. F. Neuman, "Theory of calcification"; T. Dixon, "Origin and nature of bone citrate."

July 21, Dynamics of calcium metabolism, W. D. Armstrong, chairman: D. L. Buchanan and A. Nakao, "Physiological status of bone carbonate"; C. J. Maletskos, "Dynamic model of calcium metabolism"; William P. Norris, "Radiocalcium and radium studies"; M. Rubin, subject to be announced. J. E. Howard, chairman: H. D. Copp, "Calcium and phosphorus homeostasis."

July 22, Nutritional Factors, R. S. Harris, chairman: J. Cohen, "Never studies on vitamin A in bone growth"; C. L. Comar, "Calcium metabolism and bone formation"; H. E. Harrison, "Vitamin D in calcium metabolism"; W. van Robertson, "Ascorbic acid in fibrogenesis."

Afternoon workshop—some analytical aspects, J. Sendroy,

Jr., chairman. H. H. Mitchell, chairman: R. Nicolaysen, "Physiological basis for evaluation of man's calcium requirements." Panel discussion: L. Barnes, H. H. Mitchell, R. Nicolaysen, D. Watkin, "Human requirements for calcium."

July 23, *Physiological Aspects of Bone Formation*, R. Fellis, chairman: J. Arnold, "Bone remodeling"; G. Bevelander, "Histochemistry of osteogenesis"; P. Munson and A. D. Kenny, "Nature and mechanism of action of parathyroid hormonal activity"; N. S. McDonald, "Some aspects of radio-strontium deposition."

CHEMISTRY AT INTERFACES

Sydney Ross, chairman

July 26, *Foams and emulsions*: Sydney Ross "Recent researches on foams and antifoams"; J. J. Spitzer, "Lipemia, a physiological fat emulsion"; H. L. Davis, "Albumin-lipid systems."

July 27, *Emulsions and cell interfaces*: H. Necheles, "Recent researches on physiological fat emulsions"; H. L. Davis, "Agglomeration of blood components by lipids"; Eric Hutchinson, "Hemolysis by alkyl sulfates."

July 28, *Solid interfaces*: Sydney Ross, "Adsorbed films on homotattic surfaces: historical"; Sydney Ross, "Two-dimensional phase transitions on solids"; Donald Graham, "Interaction and condensation in adsorbed monolayers."

July 29, *Solid interfaces*: Ben Millard, "Adsorption of krypton and argon by barium sulfate"; F. H. Healey, "Heat of immersional wetting of solids by liquids."

July 30, *Solid interfaces*: Discussion: "Adsorption of water by hydrophobic surfaces; Summary and conclusions."

INFRA-RED SPECTROSCOPY

R. C. Lord, chairman

Interpretation of infra-red spectra of large molecules

Aug. 2: R. C. Gore, "Structural information from group frequencies"; H. W. Thompson, "Fundamental consideration of frequency correlations"; M. K. Wilson, "Uses and limitations of frequency calculations."

Aug. 3: R. Norman Jones, "Structural information from quantitative intensities"; E. Bright Wilson, Jr., "Absolute intensities and their relation to the electric structure of molecules"; N. Fuson, "Solvent effects and their use in interpretation of spectra."

Aug. 4: R. Mecke, "Dielectric effects on infra-red spectra of hydrogen bonds"; W. C. Price, subject to be

announced; R. C. Lord, "Relation between infra-red spectra and hydrogen-bond strength."

Aug. 5: R. S. Halford, "Infra-red absorption in crystals and the structure of complex molecules"; G. B. B. M. Sutherland, "Relation between x-ray results and infra-red spectra of large molecules."

Aug. 6: R. M. Badger, "Amide frequencies in relation to the structure of polypeptides"; E. R. Blout, "Interpretation of amide and peptide spectra."

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News and Notes

Science News

As a result of the editorial "Shall All International Congresses Be Held Abroad?" [*Science* 119, 3A (Mar. 19, 1954)], Donald P. Rogers, curator of The New York Botanical Garden, New York City, addressed the following letter to The House Judiciary Committee:

I am informed that you have under consideration H. J. Resolution 308 providing for the admission to the United States for a limited period of scientists who are at present excluded by certain provisions of the McCarran Act. I am not acquainted with the precise wording of this new bill; I should nevertheless like to urge that some such provision be enacted.

As a member of the Resolutions Committee of the Seventh International Botanical Congress, held at Stockholm in 1950, I took part in the discussion and voting on the location of the next congress. Because the programs of such congresses include important information concerning the most recent discoveries in botany and in such dependent fields as genetics and agronomy, and because they are attended by many of the leading scientists in the field, it is considered highly desirable that they be variously located over the years, so that as many scientists as possible, especially the younger ones, whose financial resources limit their travels, will be able to attend. None has ever been held in the United States; and the committee members from this country having in mind the benefit to American science that could be derived from the next congress, worked hard to have it brought here. We lost by a rather narrow margin; and I believe that one reason for this was the fact that a certain number of foreign scientists would be barred from attending a congress in this country by our immigration laws.

The experience of the Stockholm Congress indicates the small danger of opening our doors for such a purpose to scientists of political views opposed to our own. First, a number of scientists of high standing from Russian satellite countries submitted titles, which appeared on the program; but none of those I hoped to hear succeeded in reaching Stockholm. The conclusion generally accepted was that they had been prevented by their masters from leaving their own countries. The effect on the standing of Russia was considerable; whereas if Sweden had excluded them, the ill-will would have been directed toward the host country.

Second, a delegation of five Russian botanists appeared at Stockholm, without previous warning, and asked for places on the program. This request was met in part by the scheduling of a special meeting for the Soviet geneticists, at which they expounded their peculiar and politically dictated theories of genetics. Their contentions were questioned by many of those present, and were successfully refuted by a Portuguese botanist using the evidence provided by a distinguished American scientist. The result was a conspicuous defeat for what its exponent called Soviet science. Had the Russian speaker not had an opportunity to argue his case, the onus of suppression of evidence would have fallen on those who prevented his speaking.

Third, after the congress the Soviet delegation visited a number of Swedish botanical research institutions. The ill-will that they managed to arouse resulted in at least two scathing articles in Swedish scientific journals.

Fourth, at the last session of the congress the Soviet delegation managed to make a display of ineptitude and bad manners, in the matter of the presentation of a wreath for the tomb of the great Swedish scientist Linnaeus, that made them an occasion for amusement and derision among the representatives of other nations.

In summary, a change in our statutes which will permit the holding of truly international scientific congresses in the United States will benefit American science and scientists; and this country has nothing to fear from the attendance of politically unacceptable foreign delegates at such meetings.

Expressing an additional viewpoint, Walter Landauer, professor of genetics at the University of Connecticut, has written this to *Science*:

The editorial "Shall all international congresses be held abroad?" . . . appeals to scientists to write to the House Judiciary Committee in support of legislation that would facilitate the admittance to this country of visiting foreign scientists. Deplorable as are many of the provisions of the McCarran Act, it seems to me antisocial and unethical to plead for the establishment of an exceptional status for scientists. If the existing laws are unfair, they should be opposed on that basis rather than because of the more or less selfish interests of the American scientific community. Even the admission that these interests may be of great importance for America's future should not alter our opposition to preferential legislation. Visits by artists, philosophers, humanists, and others may be equally or more important.

The American Museum of Natural History has announced the return of the 4th Archbold Expedition to New Guinea and the arrival of 98,000 zoological and botanical specimens collected during 8 mo in the eastern part of the Territory of Papua. The members of the expedition, whose work was partly sponsored by Richard Archbold, research associate of the Museum, included leader and botanist Leonard J. Brass of the Archbold Biological Station at Lake Placid, Fla.; Hobart M. Van Deusen, a member of the Museum's Department of Mammals; and Geoffrey M. Tate, in charge of the Archbold Expedition's New York headquarters, located at the Museum.

The collections—which may be divided into groups of 1950 mammals, 1650 reptiles and amphibians, 230 freshwater fishes, 80,000 insects and spiders, and 14,000 plants—were made in dry coastal areas, in rain forests, mountain forests, and alpine grasslands. The scientists made their first base of operations at Menapi on the Cape Vogel peninsula, after which they proceeded to camps in the Mt. Dayman area of the Central Range at altitudes of 7300, 5100, 3000, and 650 ft. The final collecting was done on Goodenough Island, one of the D'Entrecasteaux group that lies just to the east of New Guinea.

Studies based on the collections and on notes made in the field will be added to the conclusions of earlier Archbold Expeditions to this part of the world—three

to other sections of New Guinea and one to the Cape York Peninsula of Australia. The over-all project for which these investigations have been conducted is a study of the relationships of the fauna and flora of New Guinea, Malaysia, and Australia. In addition, the 1953 expedition collected parasites of warm-blooded animals for the research department of the Army Medical Service.

To help with the collecting, to make the camps, and to carry the two tons of supplies and equipment shipped out to the expedition from New York, nine full-time native workers and 60-70 part-time porters were hired. In addition to Richard Archbold, the American Museum of Natural History, the Arnold Arboretum of Harvard, and the Office of Naval Research also sponsored the 1953 expedition.

Scientists in the News

D. P. Barnard of Chicago, research coordinator for the Standard Oil Company (Ind.), has been made Deputy Assistant Secretary of Defense (Research and Development).

J. L. Collins, head of the Department of Genetics, Pineapple Research Institute of Hawaii, Honolulu, retired in March after 25 yr of service. He has long been active in local scientific organizations, having served as president of the University of Hawaii chapter of Sigma Xi, the Hawaiian Academy of Science, and the Botanical Society.

Harry Waller Daniels has moved to Caracas, Venezuela, to take a position as head of the program development subsection of the Training Section for Creole Petroleum Corporation. Dr. Daniels was previously associated with Richardson, Bellows, Henry and Company as a project manager. His new address is in care of the company, Apartado 889, Caracas.

Robert H. Eustis, formerly chief engineer of the Thermal Research and Engineering Corporation, Conshohocken, Pa., has joined the physics staff of the Stanford Research Institute. A specialist in problems of combustion, heat transfer, and fluid mechanics, he will work in the Heat and Mechanics Section.

Ray H. Everett, a pioneer in the fight against venereal disease, is retiring as executive secretary of the Social Hygiene Society, Washington, D.C. He has devoted 36 yr to the field of social hygiene and was one of the first men in the country to make venereal disease a mentionable subject. Mr. Everett also is well-known for his pungent advice as a marriage counselor, his advocacy of sex education in the schools, and his humorous verse.

In February and March **Henry Eyring**, dean of the graduate school and professor of chemistry at the University of Utah, discussed "Nonlinear departures

from equilibrium" at a number of colleges and universities as a Sigma Xi national lecturer.

Donald A. Fraser, formerly research officer at the Forest Insect Laboratory, Sault Ste. Marie, Ont., Canada has been appointed forest ecologist at the Petawawa Forest Experiment Station, Chalk River, Ont.

R. Ruggles Gates, geneticist and emeritus professor of botany, University of London, who is now affiliated with the Harvard University Biological Laboratories, left Mar. 1 for a 3-mo visit in Japan. He will study the Japanese war children in the vicinity of Tokyo and also the Ainu tribe in Hokkaido. He plans to give lectures at several universities and to genetics societies.

Russell Gibson, associate professor in the Division of Medical Sciences, Harvard University, retired from active teaching a year ahead of schedule and is working for the U.S. Government in Iran.

Marburg University, Germany, has awarded this year's Emil von Behring prizes—each consisting of a medal, a scroll, and \$1190—to the following three men: **Michael Heidelberger**, professor of immunology at Columbia University; **Sir Macfarlane Burnet**, director of the Melbourne Medical Institute, Australia; and **Hans Schmidt**, former director of the Emil von Behring Institute for Experimental Therapy in Marburg.

Dr. Heidelberger also received another honor recently when the City College (N.Y.) Chemistry Alumni Association presented him with its Bicentennial Lecture Award Medal. The award lecture was on the subject "From immunology to quantitative immunology."

The American Mathematical Society awarded its 1953 Bôcher Memorial Prize to **Norman Levinson** of the Massachusetts Institute of Technology for the contributions to the theory of linear, nonlinear, ordinary, and partial differential equations contained in his papers of recent years. This prize is awarded every 5 yr for a notable research memoir in analysis that has appeared during the preceding 5-yr period in a recognized journal published in the United States or Canada.

Warren C. Lothrop, a member of the staff of Arthur D. Little, Inc., Cambridge, Mass., since 1946, has been appointed vice president in charge of research and development. This division will be housed in the new 60,000-ft² laboratory now being completed in West Cambridge.

Charles W. Mayo, a governor of the Mayo Clinic and a member of the U. S. delegation to the 8th General Assembly of the United Nations last year, has been elected president of the American Association

for the United Nations. The Association is an unofficial body for the promotion of the U.N.'s activities.

Two faculty members in the School of Agriculture at North Carolina State College, **Zeno Payne Metcalf** and **Walter John Peterson**, have been named William Neal Reynolds professors of agriculture. A professor of zoology and entomology and for 10 yr director of graduate studies, Prof. Metcalf has been affiliated with the College since 1912. Prof. Peterson joined the staff in 1942 as head of the Nutrition Section, Animal Industry Department, then became head of the Chemistry Department.

John Punnett Peters, professor of medicine at Yale University who was dismissed from a Government advisory post last June 12 on loyalty grounds, has filed suit for reinstatement charging that his constitutional rights were violated. The suit has been filed in the U.S. District Court for the District of Columbia. Dr. Peters was a special consultant to the U.S. Public Health Service of the Federal Security Agency.

Two hearings into Dr. Peters' activities, associations, and memberships in various organizations conducted by FSA's loyalty board resulted in findings that no reasonable grounds existed for belief that he was disloyal. However, a third hearing before the over-all Loyalty Review Board (since dissolved), culminated in a decision of "reasonable doubt," and Dr. Peters was subsequently discharged and barred from working for the Government for 3 yr.

R. L. Petritz of the Physics Department at Catholic University and the Physics Research Department, U.S. Naval Ordnance Laboratory, White Oak, Md., has received the Browder J. Thompson Memorial Prize from the Institute of Radio Engineers for his paper entitled, "On the theory of noise in P-N junctions and related devices," which was published in a special transistor issue of the *Proceedings* of the IRE.

At its recent annual meeting the National Society for Medical Research, Chicago, gave citations to the following three men:

Anton Rost, former president of the National Canine Research Foundation, for his many constructive suggestions on the better care of laboratory animals.

Walter Alvarez, Chicago physician and medical columnist, for his constant attention to the importance of basic medical research.

A. C. Ivy, head of the Department of Clinical Science at the University of Illinois College of Medicine, for his long and outstanding service to the Society and "... his significant service in promoting public understanding of the necessity, and the value of animal experimentation for the advancement of biology and medicine."

Harold W. Schwalm, formerly a farm advisor in Kern and Los Angeles counties, has been appointed regional director of the Southern California Agricultural Extension Service, which has recently established headquarters on the Riverside campus of the University of California.

At its annual meeting the American College of Radiology presented **W. H. Stewart** of New York, 85 yr old, with a gold medal in recognition of his "distinguished and extraordinary service to the American College of Radiology and to the profession for which it stands." A second medal for similar service was presented to **Benjamin H. Orndoff** of Chicago. Both men are past presidents of the organization.

Education

Ralph Iler of E. I. du Pont de Nemours and Company has been appointed **Baker Lecturer in Chemistry at Cornell University**, where he began a month's lectureship on Apr. 6. The title of his series is "Colloid Chemistry of silica and silicates."

A course in medical mycology that has been offered each summer for the past 7 yr at **Duke University School of Medicine and Duke Hospital**, will be given again this summer. It is designed to give the student a working knowledge of the human pathogenic fungi and an understanding of the diseases which they cause. Instruction by members of the departments of medicine, pathology, and bacteriology will emphasize the clinical, pathological, and therapeutic aspects of fungus infections. Patients, clinical materials, cultures, and laboratory animals will be available. An opportunity to study pathological materials, gross and microscopic, will be given those whose interest and previous training would make this of value to them. The practical laboratory aids that help to establish a definitive diagnosis will be stressed.

The course is open to clinicians, pathologists, bacteriologists, technicians, and others who have an interest in the medical phases of mycology. Classes meet 6 days a week from July 5 to July 31. Inquiries should be directed to Dr. Norman F. Conant, Duke Hospital, Durham, N.C.

By a recent action of the Tennessee State Board of Education, **East Tennessee State College** at Johnson City may now offer graduate majors in biology and chemistry leading to the M.S. degree.

By helping to raise the standards of foreign medical schools, the medical schools in the United States will also be benefiting themselves, according to an article by **Henry R. O'Brien** of the Public Health Service published in the March issue of *The Journal of Medical Education*. Dr. O'Brien suggests several methods to improve medical education abroad without sacrificing the standards of American medical colleges. He feels that a few students from foreign schools should be trained in this country with the idea of eventually returning to their native lands and introducing ideas from U.S. schools. The founding of local or regional foreign schools with standards higher than most of those now existing abroad is the best answer to the problem, according to Dr. O'Brien.

Opportunities for graduate education in this coun-

try and for international meetings of doctors would facilitate an interchange of information that would benefit all concerned. Dr. O'Brien also recommends an increased exchange of teachers.

He refers to the suggestion of the Committee on International Relations in Medical Education of the Association of American Medical Colleges that medical schools link themselves with a foreign school. In 1951 the Public Health Service and the Economic Cooperation Administration made funds available for an exchange of faculty and residents. Washington University began the program by linking with two medical schools in Bangkok, and California is considering an affiliation with Djakarta.

ECA, World Health Organization, Fulbright Scholarships, the Public Health Service, the Rockefeller Foundation, and others also have given assistance to the program. Dr. O'Brien feels that the increased use of these methods will help to eliminate the problem of foreign students coming to this country with the hope of entering our medical schools, only to find that they cannot meet the admission standards. At the same time, American medical schools can better serve their own students through the exchange of personnel, information, and new ideas.

The annual **Hughlings Jackson Memorial Lecture-ship** will be held this year on May 19 in the amphitheater of the Montreal Neurological Institute. Th. Alajouanine, Prof. à la Faculté, Paris, will deliver the address, "On some aspects of verbal expression in aphasia."

In the belief that one of the great problems of the modern world is the tendency of people to give up moral, ethical, and religious standards and values as they acquire knowledge and understanding of the foundations of the natural sciences, the Danforth Foundation, in cooperation with the Summer Sessions at The Pennsylvania State University, is sponsoring a **1954 Summer Sessions Workshop on The Teaching of the Natural Sciences in Relation to Religious Concepts**. Natural science teachers with a background and a working interest in such problems will, it seems, play a larger and larger part in the direction of social forces as their special capabilities become more in demand. This workshop will be held at The Pennsylvania State University for two weeks, beginning July 6.

William G. Pollard, executive director of the Oak Ridge Institute of Nuclear Studies, will be one of the participating lecturers. A nuclear physicist and industrial consultant, Dr. Pollard is also an ordained Deacon of the Episcopal Church. Harold K. Schilling, the other seminar lecturer, became professor and head of the Department of Physics at the Pennsylvania State University in 1947, and dean of the Graduate School in 1950. Dr. Pollard's lectures will be devoted to the interpretation of the natural sciences and religion and their interrelation, to a consideration of the nature of physical reality, and to the application of

religious principles. Dr. Schilling will deal more specifically with educational matters, both the purposes, and the strategy and tactics of curricular and extra-curricular teaching. In his lectures he will attempt to develop a point of view regarding the task of the Christian teacher, to identify and analyze teaching problems in the area of the relations between the natural sciences and religion, to suggest appropriate teaching techniques, and to formulate questions and point up issues for discussion in the workshop sessions.

The director of the workshop this summer is W. C. Fernelius, head of the Department of Chemistry at the Pennsylvania State University. Admission will be limited to 50 college teachers of natural sciences who have had at least three years of teaching experience. Through the cooperation of the Danforth Foundation, Inc., 25 full scholarships, covering fees, board, and lodging, are available for qualified applicants. For further information write Dr. W. C. Fernelius, State College, Pa., Attention: Danforth Scholarship Committee.

A \$20,000 electron microscope has been installed at the **University of Georgia**. Under the direction of Paul R. Burkholder, discoverer of the mold that contains chloromycetin and new head of the Department of Bacteriology, it will be used primarily to speed research on southern plant and animal diseases and various fundamental problems in biology.

Grants and Fellowships

The American Academy of Arts and Sciences has awarded the following grants, included in 12 totaling \$8885, from its Permanent Science Fund:

Harvard University. E. Barghoorn, Dept. of Botany. Stratigraphic position, geologic relations, and paleontologic origin of a pre-Cambrian coal deposit and associated fossiliferous shales in the Michigamme Shale of the Negaunee Iron Range.

University of Illinois. R. F. Erickson, Dept. of History. Contributions to 18th century science of the French Academy of Sciences expedition to South America, 1735-1744.

Harvard University. W. N. Irving. Eskimo and pre-Eskimo remains in the western Brooks Range of northern Alaska.

Wabash College. W. H. Johnson, Dept. of Zoology. Development of a chemically defined medium for the sterile culture of *Paramecium*.

Ohio State University. R. F. Novotny, Dept. of Geology. Bedrock geology of the New Hampshire portions of the Dover, Exeter, and York quadrangles.

Harvard University. R. A. Paynter, Jr., Museum of Comparative Zoology. Ornithological survey of the Lacandon Region of Chiapas, Mexico.

University of Southern California. S. C. Rittenberg, Dept. of Bacteriology. Metabolic activities of virulent and avirulent strains of *Bacillus anthracis*.

Harvard University. R. A. Scott, Dept. of Biology. Collection and investigation of fossil fruits and wood from the Eocene Clarno formation of Oregon.

Boston University. T. C. Smith, School of Medicine. Action of hormones in growth processes.

In February the **Damon Runyon Memorial Fund** allocated \$61,000 for institutional research grants.

Sloan-Kettering Institute for Cancer Research. C. P. Rhoads. Investigative care of children with cancer, with particular reference to 6-mercaptopurine and compounds related thereto, \$15,000.

New York University. M. J. Kopac. Ultraviolet micurgy, \$10,750.

Trudeau Saranac Laboratory. G. W. H. Schepers. Environmental cancer: the capacity of inhaled industrial dust to produce pulmonary cancer in experimental animals, \$9000.

St. Vincent's Hospital. Antonio Rottino. Acid-fast properties of Hodgkin's tissue, \$5700.

College of the City of New York. Society for Experimental Biology and Medicine. Publication of cancer research articles, \$100.

University of Washington. W. Volwiler. School of Medicine. Cytologic studies of gastrointestinal cancer and precursors, \$10,000.

Los Angeles Tumor Institute. H. F. Hare. Supervoltage radiation effects on normal cells and the possibilities of increasing the effectiveness of this therapy by the addition of chemical substances, \$8000.

Florida Southern College. B. Sokoloff, A. P. Cooke Memorial Cancer Hospital. Effect of ascorbic acid and its analog on the PNA/DNA in malignant tissue, \$2550.

The National Science Foundation has granted **Duke University Marine Laboratory**, Beaufort, N.C., \$12,000 to continue for the next three summers its program of offering 10 predoctoral scholarships of \$200 each for 6 wk of course work or research. Inquiries concerning these scholarships should be addressed to Dr. C. G. Bookhout, Zoology Department, Duke University, Durham, N.C. In addition, four postdoctoral grants of \$500 each will be made to biology faculty members from colleges and universities of the Southeast other than Duke University, for research in marine biology for a period of 12 wk. This part of the program will start in the summer of 1955 and continue for 3 yr.

Eli Lilly and Company has awarded the following research grants:

University of Chicago. C. G. Loosli, Dept. of Medicine. Use of tissue culture for the isolation of respiratory disease viruses.

Columbia University. K. Meyer, College of Physicians and Surgeons, Fellowship for A. Linker, for work on hyaluronidase.

Duke University. C. R. Hauser, Dept. of Chemistry. Synthetic organic medicinal.

University of Illinois. R. M. Kark, College of Medicine. Carnitine metabolism.

University of Michigan. R. C. Elderfield, Dept. of Chemistry. For O. McCurdy, for work on synthesis of compounds related to the alstonia alkaloids.

University of Minnesota. F. D. Boyer, Dept. of Agricultural Biochemistry. Action of certain enzyme inhibitors and activators.

University of Pittsburgh. I. A. Mirsky, Dept. of Clinical Science. Carbohydrate metabolism.

Purdue University. R. A. Benkeser, Dept. of Chemistry. Reduction of heterocyclic compounds by alkali metals in amine salts.

Purdue University. N. Kornblum, Dept. of Chemistry. Fundamental organic chemistry.

Rutgers University. U. P. Strauss, Ralph G. Wright Laboratory. Synthetic program on polysoaps.

Vanderbilt University. O. Touster, Dept. of Biochemistry. Carbohydrate metabolism in pentosuria.

University of Wisconsin. S. G. Knight, Dept. of Bacteriology. Metabolism of penicillin-producing organisms.

Harvard University has announced the award of a U.S. Public Health Service grant of \$215,000 to the Judge Baker Guidance Center and Children's Hospital for a 5-yr study of the **emotional disturbances of childhood**. Particular emphasis will be placed on the role of aggression in children. This work will be closely related to the cooperative program of study in the Department of Psychiatry of the Harvard Medical School and the Harvard University Department of Social Relations designed to provide new information

concerning the mental health of children. Funds for the research program will be apportioned at the rate of \$35,000 for the first year and \$45,000 each year for the succeeding 4 yr.

The principal investigators will include George E. Gardner, clinical professor of psychiatry at Harvard, director of the Judge Baker Center, and psychiatrist-in-chief at Children's Hospital; Samuel Waldfogel, director of research at the Judge Baker Center; and Dane G. Prugh, psychiatrist at Children's Hospital. Research personnel will be the members of the staffs of the participating groups.

The broad research areas to be investigated include juvenile delinquency, seizures, learning blocks (of an emotional nature), responses of the brain-injured child, the child facing operative procedures (surgery), and early childhood schizophrenia. Other research projects may be added later.

The fact that advancements in recent years have resulted mainly through the efforts and accomplishments of research "teams" has made it increasingly difficult for the Advisory Committee for the **John Scott Award** to recommend individuals who may qualify as recipients of the award, which at the present time consists of \$1000, a copper medal, and a scroll. The Committee has asked for cooperation in its current effort to make the existence of the award for the purpose of honoring individuals better known.

The award was established more than 125 yr ago by John Scott, an obscure Scottish chemist of Edinburgh, who died in 1816. It is believed he was influenced in making Philadelphia the instrument of his benefactions because of his admiration for Benjamin Franklin. The original bequest amounted to \$4000 and Scott's will directed that income "be laid out in premiums to be distributed among ingenious men and women who make useful inventions, but no one of such premiums to exceed twenty dollars and along with which shall be given a copper medal."

By court order in 1920 and 1921, the City of Philadelphia, Trustee, acting by the Board of Directors of City Trusts, was authorized to distribute the income in premiums not exceeding \$2000 each. None of the recipients, however, has received more than \$1000. From Mr. Scott's original legacy of \$4000, the Fund has grown to approximately \$110,000 to date. Since this award was established, more than 400 notable men and women have qualified as recipients. Among them are Orville Wright, Thomas A. Edison, Madame Curie, Guglielmo Marconi, Lee DeForrest, Irving Langmuir, and Alexander Fleming.

With the court's permission, an Advisory Committee was formed in 1919 to assist the Board of Directors of City Trusts in selecting candidates for the award. The present members of the Committee are:

Ernest T. Trigg of the Board of Directors of City Trusts, Philadelphia; John W. Iliff and J. Warren Kinsman of the E. I. du Pont de Nemours & Co., Inc.; Thomas A. Shallow of Jefferson Medical College; Wendel M. Stanley of the University of California;

Edward R. Weidlein of the Mellon Institute of Industrial Research; Henry N. Paul, Jr., Patent Attorney, Philadelphia. The corresponding members are Harlow Shapley of Harvard University and Harold C. Urey of the University of Chicago Institute for Nuclear Studies.

Fellowships offering further training for health educators who are currently employed in state departments of education or state departments of health have been announced by the National Foundation for Infantile Paralysis. These fellowships will provide for graduate study at any school of public health that is approved by the American Public Health Association. Each recipient must declare his intention of returning, upon completion of his study, to the position in which he is now employed.

Financial assistance will be given for tuition and maintenance depending upon the individual need as determined by marital status and number of dependents. Appointments will be made for 1 yr. Partial fellowships are available for qualified veterans to supplement G.I. educational benefits. Requirements include a bachelor's degree from an accredited college or university and a minimum of 2 yr of experience as an educator in the field of health. Application forms may be obtained from the Division of Professional Education, National Foundation for Infantile Paralysis, 120 Broadway, New York 5.

Meetings and Elections

The 15th Annual Biology Colloquium will be held at Oregon State College on May 8 under the auspices of Phi Kappa Phi. "Cellular biology" will be the theme, with Daniel Mazia, University of California, as leader. Among the other speakers will be Robert Chambers, New York University; H. Stanley Bennett, University of Washington; Max Alfert and William E. Berg, University of California; and Vernon H. Cheldelin, Oregon State College. For information address 15th Annual Biology Colloquium, 107 Commerce Hall, Oregon State College, Corvallis.

Officers of the Institute of the Aeronautical Sciences are: pres., J. L. Atwood; sec., Robert R. Dexter; treas., Elmer A. Sperry, Jr. Vice presidents are: W. A. M. Burden, J. W. Larson, E. T. Price, and E. S. Thompson.

The International Congress on Thrombosis and Embolism to be held in Basle, Switzerland, July 20-24, has been initiated by the University Hospital for Women, Basle, because of the increasing importance of thromboembolic diseases and of anticoagulants. During the meeting the possibility of establishing special sections within the hematological societies to cover thrombosis and embolism will be discussed.

Authors wishing to submit communications should register with the General Secretary, Gynaecological Clinic of Basle University, before May 31. Official

languages are English, French, and German, and there will be simultaneous interpretation. Detailed information can be obtained either from the general secretary or from the nearest office of the American Express Company, which will accept applications for admission to the scientific meetings and collect subscriptions for the *Proceedings*.

The Basle congress will be followed by the International Congress of Gynaecology and Obstetrics, which is to take place in Geneva, July 26-31. The theme of the meeting will be "Prophylaxis in gynaecology and obstetrics." Information and applications may be obtained from the General Secretary, Dr. W. Geisen-dorf, Maternité, Geneva.

The University of Texas Medical Branch, with the assistance and cooperation of the Josiah Macy Jr. Foundation, recently held a 3-day conference at Galveston on the subject of **Medical and Psychological Team Work in the Care of the Chronically Ill**. The conference was under the chairmanship of Molly Harrower and Paul Holbrook, with Frank Fremont-Smith representing the Josiah Macy Jr. Foundation and Chauncey Leake representing the Medical Branch.

The conference, while as a matter of policy making no specific recommendations, explored the field from many points of view. The increasing importance of team work between internists, psychologists, and psychiatrists was recognized, and various ways in which it could be improved were discussed. The problem of personnel shortage was noted as being critical, and training methods were studied with the objective of improving this situation. The possibilities of liaison between voluntary health agencies, medical schools, and governmental departments were explored. The intensity of interest shown and the gratifying results achieved convinced the majority of the conferees that future conferences of the same sort should be held.

The National Society for Medical Research has elected the following officers: pres., Anton J. Carlson; v. pres., Lester Dragstedt, University of Chicago; sec-tres., Ralph Gerard, Illinois Neuropsychiatric Institute.

The North Carolina Academy of Science will hold its 51st annual meeting, May 7-8, at East Carolina College, Greenville—the Academy's first meeting at this rapidly expanding state institution. The current president of the Academy, Dean D. B. Anderson of N.C. State College, will preside. A special activity will be the organization of the Collegiate Academy of the N.C. Academy of Science. High school exhibits and essays are also sponsored by the parent organization.

A highlight of the meeting will be the presentation of the 1953 Poterat Award for the outstanding paper in the botanical section to E. K. Goldie-Smith of the University of North Carolina for her work entitled "Members of the Plasmodiophoraceae occurring as parasites of fungi." The Poterat Award for 1954 will be presented to the author of the outstanding paper in the geology section.

The Northwest Scientific Association has elected the following officers: pres., L. C. Cady, Research Council, University of Idaho; v. pres., T. J. O'Leary, Gonzaga University; sec.-treas., Francis J. Schadeegg, Dept. of Geography and Geology, Eastern Washington College of Education.

More than 100 delegates attended the 3rd biennial symposium of the **Organic Chemistry Division of the Chemical Institute of Canada** held in Montreal in March. This established a new attendance record. G. E. McCasland of the University of Toronto, chairman of the Division, presided over all technical sessions and the dinner meeting; local arrangements were handled by Alfred Taurins of McGill University, the Division's secretary-treasurer.

Raymond U. Lemieux, the 34-yr old Canadian chemist whose synthesis of sucrose has been noted as one of the top chemical achievements of 1953, was presented with the Divisional Award at the dinner meeting. The presentation was made by one of Lemieux's former teachers, Clifford B. Purves, professor of industrial and cellulose chemistry at McGill University. Dr. Purves briefly traced the background and development of knowledge of the chemistry of sucrose from 1800 up to the present day and pointed out that "the most fascinating thing about sucrose was the steady failure of chemists to synthesize it in the laboratory."

Special speaker at the conference was Nelson J. Leonard, University of Illinois, who spoke on "Medium rings containing nitrogen." Dr. Leonard reported on a new method developed for synthesizing medium size ring compounds containing a nitrogen atom, by electrolytic reduction at a lead cathode in 30-percent sulfuric acid at 60° C, of bicyclic alpha aminoketones. tones.

A survey of recent advances in organosilicon chemistry was described by Adrian G. Brook, University of Toronto. One such advance was the development of practical methods of preparing organosilylmetallic compounds. These reagents are presently limited to the triarylsilyl derivatives of the alkali metals, but their preparation opens up a hitherto inaccessible field for synthetic and mechanistic studies. Other speakers at the 2-day meeting discussed such topics as isotope effects, acetylated sugars, oxidation of wood lignin, aconite alkaloids, monocyclic terpene chemistry, and the synthesis of highly hindered diphenyl ethers.

The program for this year's annual meeting of the **Society of American Bacteriologists**, to be held in Pittsburgh, May 2-7, promises important news for scientists in many diverse fields of research. The agenda lists over 300 original papers and 5 symposia. The titles of the latter and their conveners are: *Training of food bacteriologists*, Judd R. Wilkins; *Recent advances in bacterial cytology*, James W. Bartholomew; *Applications of tissue culture methods in the study of viral infections*, John F. Enders; *Diverse pathways of microbial metabolism*, H. G. Wood; *Steroid requirements of protozoa*, W. J. van Wagtenonk.

Many of the papers to be presented are of sufficient merit to receive special attention, but only a few may be mentioned here. The discovery of a new virus associated with cases of primary atypical pneumonia and undifferentiated acute respiratory disease will be reported by a team of workers from the Walter Reed Army Medical Center and Ft. Leonard Wood; the new virus has been isolated, shown to be of etiological significance by serological methods, and grown in tissue culture. Its separation and differentiation from influenza virus was established.

The applications of tissue culture methods in the study of viral infections will be discussed by a panel composed of T. H. Weller, J. T. Syverton, W. F. Scherer, J. E. Salk, J. S. Younger, G. C. Brown, R. Dulbecco, M. Vogt, and A. G. R. Strickland. The use of tissue culture methods will be considered from the standpoint of etiologic studies, continuous cultures for assay, application to studies of poliomyelitis, metabolism of viruses, and interactions between animal viruses and neutralizing antibodies.

Reports on the discovery, characterization, mode of action, and clinical trials of several chemotherapeutic drugs also are expected to be of considerable interest. A partial list of antibiotics and synthetic drugs which will receive attention are streptogramin, bicillin, azaserine, candidin, ascocin, candicidin, trichomycin, benzimidazole derivatives, and certain tryptophan analogues.

At the symposium on microbial metabolism new enzyme systems involved in the metabolism of carbohydrates will be discussed by Bernard L. Horecker, Michael Doudoroff, L. O. Krampitz and R. E. Kalli. Amino acid metabolism will be considered during the regular Tuesday morning session. The discovery and characterization of D-amino acid transaminases will be described by Curtis B. Thorne. A new enzymatic transfer reaction resulting in the synthesis of gamma-linked peptides will be characterized by William J. Williams and Curtis B. Thorne and Jack Litwin.

The many papers and symposia for this meeting do not alone indicate the accomplishments and productivity of SAB members during the past year. Within the past 12 months members have published more than 20 books (not including laboratory manuals) in diverse fields from strict science to pure history; they include treatises on individual diseases, and textbooks and books devoted to specialized areas of bacteriology, virology, mycology, immunology, bacterial genetics, antibiotics, and biography. For the second successive year, a member of the Society was the recipient of a Nobel prize: Fritz Lipmann of Harvard University, for his work on the function and structure of Coenzyme A, shared this honor with H. A. Krebs. Selman A. Waksman received the prize in 1952.

The fourth annual **Summer Institute for the Teaching of Chemistry**, sponsored by St. Louis University, will be held this year from June 21 to July 30. The summer program offers four types of activity: (1) lecture courses, which are mainly of the survey type

and consider both fundamental and advanced ideas in the major fields of chemistry; (2) seminar in problems of the teaching of chemistry, which treats such subjects as evaluation of student performance, methods of instruction, course-content at various levels; (3) field studies, which include visits to industrial plants and laboratories in order to observe current research and development in industrial chemistry, and visits to institutions carrying on active research such as electron microscope work, microseismograph research, use of the cyclotron, and studies of low-temperature life; and (4) the special lectures.

Although the Institute is part of the university's program leading to the M.S. degree in the teaching of chemistry, it is also open to high school teachers. Further information may be secured from Dr. Theodore A. Ashford, Director of the Institute.

At the meeting of the International Union of Biological Sciences held at Nice in August 1953, a **type-figuring subsection of the Entomology Section** was formed. The objective of the subsection is to make information on types of insects and other animals as readily available as possible, especially by distributing figures of type specimens to assist in research work, and by keeping information on file in event types should accidentally be destroyed. The activities of the subsection are directed by a committee under the chairmanship of N. D. Riley, Keeper, Department of Entomology, British Museum (Natural History), London, SW7.

The aims of the subsection are: to collect in a central file negatives of photographs of type specimens, or of photographs of drawings or other illustrations of type specimens or of their parts; to catalog these and make lists available from time to time; to make and to distribute prints of the photographs, for suitable fees, to those requesting them; and, when finances permit, to make or arrange to have made illustrations of types for the central file.

The scope and degree of success of the work of the subsection will depend on the amount of cooperation provided by institutions and individuals who have custody of type specimens. The chief form of cooperation needed is the supplying of negatives or other illustrations for the central file. Unpublished illustrations are, of course, the most desirable. It is hoped that those who have custody of types will be ready to make information on these types available and will cooperate in contributing negatives as far as their facilities permit. The subsection is run on a nonprofit basis and in fact will operate at a financial loss until receipts from the sale of prints cover expenses or until grants are obtained.

It is proposed that organizations who contribute negatives shall retain title to them, except where the original photographing has been done under a grant from the subsection, but that they shall deposit them on indefinite loan to the Central File of Figures of Types. The right to publish, or to grant permission to publish, is understood to be accorded, for the period

of the loan, to the committee or its duly accredited representatives. It is hoped that loans will be permanent, but contributors are protected by retaining the right to withdraw their negatives if they desire to do so.

The headquarters of the subsection and the central file are located at Ottawa, but later can be transferred elsewhere if a more suitable location should be found. Meanwhile, correspondence may be addressed to Mr. P. F. Bruggemann, Curator, Division of Entomology, Science Service Building, Ottawa, Ontario. Members of the committee will welcome comments, suggestions, and, particularly, offers of cooperation.

Miscellaneous

The following chemicals are wanted by the Registry of Rare Chemicals, Armour Research Foundation of Illinois Institute of Technology, 35 W. 33 St., Chicago, Ill: chromium hexacarbonyl; silicon selenide; lactic aldehyde; dimethylphosphine; p-tolylarsonic acid; pyralin; dimethyl diglycolate; isobutylene oxide, 2,5,4'-triethoxydiphenyl-1-diazonium chloride; quinquephenyl; 1,3-dioxane; 1-methylxanthine; 2,3,5,6-tetrahydroxybenzoquinone; N,N-dimethyl-laurylamine; 1-methylguanine; methylnitrolic acid; N-methyliminodiacetic acid; stachyose; peroxidase; actinomycin.

On Apr. 19, in recognition of Pan American Day and the Organization of American States, the Smithsonian Institution is conducting a ceremony at the U.S. National Museum to inaugurate a new exhibit hall entitled "Highlights of Latin American Archeology."

The Nuclear Data Group of the National Research Council is now printing new nuclear data items on 3×5 in. cards which are being made available in sets of about 100 for monthly distribution to subscribers. The card system is designed to make it possible to collect quickly and conveniently information either on particular nuclei or on particular properties of nuclei. These cards are a step in preparing quarterly lists of new nuclear data for publication in the Atomic Energy Commission's *Nuclear Science Abstracts*, similar to those that have appeared there in the past 2 yr. In 1954 these quarterly lists will be steadily cumulative; that is, each issue will contain a cumulation of all the data abstracted in the preceding months of 1954.

A number of individuals, laboratories, and libraries have already subscribed to the card sets, which are being offered through the Publications Office of the National Research Council, Washington 25, D.C., at an estimated cost of \$20.00 per year. It is hoped that as the card project becomes established the subscription price can be materially reduced. The Nuclear Data Group, which now consists of K. Way, G. H. Fuller, R. W. King, C. L. McGinnis, and A. L. Hankins, is supported by the Atomic Energy Commission and the National Bureau of Standards under the sponsorship of the National Research Council.

Technical Papers

Early Pre-Cambrian Carbon of Biogenic Origin from the Canadian Shield

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In a previous paper (1), the isotopic constitution of carbon was reported in the suggested pre-Cambrian fossil *Corycium enigmaticum* Sederholm, which occurs in a phyllite at Aitolahti in the Tampere schist belt, Finland. This carbon, because of its isotopic constitution and geologic manner of occurrence, proved to be of biogenic origin, and it was concluded that the *Corycium* is a genuine pre-Cambrian fossil. With an estimated age of 1.5×10^9 yr, the *Corycium* was regarded the most ancient proof of existence of life then known.

While the search was continued for carbon of biogenic origin in rocks still more ancient than the phyllites of the Tampere area, notice was taken of the occurrence of carbonaceous slates of extremely ancient age in the sedimentary series of southeastern Manitoba in Canada. This note announces the results of an isotopic investigation of carbon in five specimens of such slates. A more complete report is in preparation (2). The geologic and isotopic evidence serving to disclose the biogenic or nonbiogenic origin of carbon in pre-Cambrian rocks of argillaceous origin was reviewed in another paper (3). The conclusion was reached that, in the absence of contradictory geologic evidence, one is entitled to infer that the finely disseminated carbon, even in early pre-Cambrian slates and schists, and the carbonaceous accumulations in such rocks are of biogenic origin if their isotopic constitution falls within the biogenic range—that is, if the $^{13}\text{C}/^{12}\text{C}$ ratio of such carbon exceeds 90.5.

The carbonaceous slates investigated (4) belong to the sedimentary member of the Rice Lake group. The sedimentary member overlies a volcanic member and is the younger of the two (5, 6). The Rice Lake group is older than a group of exposed igneous rocks ranging from peridotite to granite in composition that is intrusive into rocks of the Rice Lake group (7). All these rocks belong to the Superior province where an over-all age of 2.2×10^9 yr for the intrusive bodies is indicated (8). This age is computed from the lead-isotope and strontium ages of uraninite, monazite, and lepidolite from albite pegmatites associated with granites that are intrusive into the Rice Lake-group rocks (9, 10, 11). It is supported by independent helium ages of pillow lava and magnetite (12, 13). After careful consideration of the accumulated evidence, it appears that an average age of approximately 2.4×10^9 yr is not unreasonably high for the pegmatite minerals, the youngest members of an igneous sequence, and that, consequently, the average age of the igneous

complex, with a reasonable margin of safety, is no less than 2.4×10^9 yr. The Rice Lake group represents a previous geologic cycle with a length no less than 0.15×10^9 yr (9), and consequently its age is approximately 2.55×10^9 yr.

All the specimens investigated are black dense slates, very rich in finely disseminated carbon and having a more or less well-developed fissility. Some of them are strongly folded, and some are obviously affected by a later hydrothermal alteration. Their degree of metamorphism usually is surprisingly low. All geologic and petrographic evidence indicates that these rocks originally were pelitic sediments, namely, silts and muds containing carbonaceous matter. Notwithstanding their extremely ancient age, the slates are exactly similar to their younger counterparts.

The isotopic constitution of carbon (14) in the slates is presented in Table 1. Three of the specimens,

TABLE 1. Isotopic constitution of carbon in slates.

Specimen no.	Description	$^{13}\text{C}/^{12}\text{C}$
1-A-48	Black slate, shore of Conley Bay, Wallace Lake	90.66
2-A-48	Black slate, same locality	90.86
3-A-48	Black slate, Clangula Lake	90.06
5-A-48	Black slate from a drill core, unknown locality in the Rice Lake district	91.20
C-1-R-50	Black slate, Orogrande Dock, E. of Beresford Lake	90.32

namely, 1-A-48, 2-A-48, and 5-A-48, fall within the biogenic range. The last-mentioned slate, however, probably is from a complex younger than the Rice Lake group. Specimens 3-A-48 and C-1-R-50 that are rather strongly affected by tectonic movements fall below the biogenic range. Because in the Wallace Lake slates carbon lies in the biogenic range, and because these slates, geologically and lithologically, do not differ from their younger counterparts in which the biogenic origin of carbon has been established beyond doubt, the conclusion follows that their carbon is biogenic in origin. This conclusion may be extended to the Clangula Lake and Beresford Lake specimens, even though the evidence appears less convincing. These four slates, however, belong to the same group, and there is no evidence indicating that the slates with the heavier carbon were formed in a way different from the way in which the slates with the lighter carbon were formed.

Consequently, isotopic data supported by geologic evidence indicates that the carbon is of biogenic origin in at least some of the early pre-Cambrian carbonaceous slates from the Canadian Shield. In other words, living organisms were in existence already some 2.55×10^9 yr ago. It is, however, impossible to decide

what kind of life the ancient carbonaceous remains in the rocks of the Basement Complex represent. Considering the age of 3.5×10^9 yr of the upper lithosphere (15), one is tempted to conclude that conditions probably were favorable for the creation of life soon after the making of a solid crust of the earth. In a paper in preparation (2), the manner of occurrence of carbon in the early pre-Cambrian argillaceous sediments will be discussed, with special reference to the hypothesis of a reducing primordial atmosphere (16).

The validity, in principle, of using the isotopic constitution of carbon in rocks as an indicator of its biogenic or nonbiogenic origin has been questioned on isotope chemical grounds (17, 18). These arguments are answered in detail in another paper (3). It is sufficient to state in this note that geologic evidence must be considered very carefully when minerals and rocks are investigated and that arguments based solely on chemical evidence obtained in the laboratory may fail partly or totally. Of course, it is not always possible to decide whether the carbon in a rock is of biogenic or nonbiogenic origin. It is known that carbon in igneous rocks may lie in the biogenic range (17, 19, 20). In an igneous rock, this gives no proof of the derivation of carbon by biogenic contamination, unless, as in the instance of the Disko Island basalt (20), there exists conclusive geologic evidence indicating the origin. Predictions relative to expected isotopic fractionation by natural processes involving exchange equilibria should be based, among other things, on equilibria representing reactions that are probably operative, or at least approximated, in natural processes (21).

References and Notes

1. Kalervo Rankama. *Bull. Geol. Soc. Amer.* **59**, 389 (1948).
2. Kalervo Rankama. To be published in *Compt. rend. soc. geol. Finlande*.
3. Kalervo Rankama. *Geochim. et Cosmochim. Acta*. In press.
4. Thanks are due J. D. Allan, formerly of the Mines Branch, and G. H. Charlewood, of the Mines Branch, Winnipeg, for specimens and pertinent geologic information.
5. G. A. Russell. Preliminary Rept. 47-1, Manitoba Mines Branch (1948).
6. G. A. Russell. Preliminary Rept. and Map 48-3, Manitoba Mines Branch (1949).
7. J. F. Wright. *Can. Dep. Mines and Resources, Mines and Geol. Branch, Bur. Geol. and Topography, Mem. 169* (1932, reprinted 1938).
8. J. Tuzo Wilson. *Can. Mining Met. Bull.* **1949**, 231 (1949).
9. Arthur Holmes. *Trans. Edinburgh Geol. Soc.* **14**, 176 (1948).
10. L. H. Ahrens. *Nature* **160**, 874 (1947).
11. L. H. Ahrens, and Lorraine G. Gorfinkle. *Nature* **166**, 149 (1950).
12. H. C. Horwood, N. B. Keevil. *J. Geol.* **51**, 17 (1943).
13. Patrick M. Hurley. *Science* **110**, 49 (1949).
14. The $^{13}\text{C}/^{12}\text{C}$ ratios in Table 1 refer to the Stockholm carbon standard. Thanks are due Frans E. Wickman, of Stockholm, through whose courtesy the isotopic analyses were made.
15. C. B. Collins, R. D. Russell, and R. M. Farquhar. *Can. J. Phys.* **31**, 402 (1953).
16. Harold C. Urey. *Proc. Natl. Acad. Sci.* **38**, 351 (1952).
17. Harmon Craig. *Geochim. et Cosmochim. Acta* **3**, 52 (1953).
18. Harmon Craig. *Econ. Geol.* **48**, 600 (1953).
19. A. V. Trofimov. *Doklady Akad. Nauk S.S.S.R.* **85**, 169 (1952).
20. Vilgo Münther, and W. Dansgaard. *Medd. Dansk Geol. Foren.* **12** (1951).
21. Earl Ingerson. *Bull. Geol. Soc. Amer.* **64**, 301 (1953).

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Maleic Hydrazide as a Sprout Inhibitor for Sweetpotatoes¹

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Maleic hydrazide has been used to inhibit sprouting in storage of onions, Irish potatoes, and carrots (1-4). There has been no report of the successful use of this chemical (5) to inhibit sprouting of sweetpotato roots.

Preliminary experiments by the writers with pre-harvest foliage applications of the 40 percent sodium salt of maleic hydrazide in a range of concentrations from 0 to 8000 ppm in the fall of 1952 indicated sprout inhibition of the bedded roots at the highest concentration, but the results were erratic.

On September 12, 1953, toothpicks impregnated with the 30 percent diethanolamine salt of maleic hydrazide in concentrations of from 0 to 100,000 ppm in ethyl alcohol were inserted halfway into sweetpotato roots (2). Three roots of each treatment were planted in vermiculite in metal flats. Sprouting was inhibited in the roots that received concentrations of 12,000 ppm or greater of the chemical.

In a subsequent experiment, October 9, 1953, 60 roots of the Texas Porto Rico variety of sweetpotatoes were divided into six equal lots and were similarly treated by inserting toothpicks impregnated with the 30 percent diethanolamine salt of maleic hydrazide in the concentrations shown in Table 1. The treated roots were bedded in a hot bed maintained at 80° F by an electric soil-heating cable and covered with 2 in. of sandy loam soil.

Table 1 shows the number of slips over 6 in. in length that were harvested from each root in each

TABLE 1. Sprout production of Texas Porto Rico sweetpotatoes subsequent to treatment with maleic hydrazide* impregnated toothpicks.

Treatments Maleic hydrazide concentrations (ppm)	Average number of sprouts per root			
	Length of sprout			Total
	Over 6 in.	Over 1 in.		
	11/16/53	11/24/53	12/14/53	
0	5.4	6.1	4.7	16.2
1,000	4.8	6.3	3.8	14.9
2,000	4.2	2.0	8.6	14.8
4,000	8.6	1.8	5.0	15.4
8,000	0.0	1.1	2.8	3.9
16,000	.0	1.6	1.9	3.5
Difference necessary for significance between treatments				
		5% level		5.44
		1% level		7.21

* Formulated as the water soluble diethanolamine salt of 1,2-dihydro 3,6 pyridazinone, and supplied by the U.S. Rubber Co., Naugatuck Division, Naugatuck, Conn.

¹ Technical Article No. 1003 of the Texas Agricultural Experiment Station.

treatment on November 16 and 24. Owing to the failure of the electric cable shortly before the second pulling of slips, the experiment was terminated on December 14, the roots were dug and washed, and the number of sprouts over 1 in. long was recorded in Table 1.

There was a highly significant reduction in total number of sprouts produced per root between the roots that were treated with 8000 or 16,000 ppm and those that were treated with the four lower concentrations of maleic hydrazide (Table 1). There were no significant differences among the four lowest or between the two highest concentrations. The striking increase in sprout production on November 16 at the 4000-ppm concentrations (Table 1) was partly due to the retarded proximal dominance of some of the roots (6).

The growth of sprouts on most of our present sweetpotato varieties and breeding lines is confined largely to the proximal end of the root. This proximal dominance of roots, like apical dominance in stems, can be broken by either chemical or mechanical means (6).

Thimann (7) has demonstrated that apical dominance in plants is controlled primarily by auxin and that stems, buds, and roots all react in a comparable way to auxin, their growth being inhibited by relatively high, and promoted by relatively low, auxin concentration. Leopold and Klein (8) have shown maleic hydrazide to be an anti-auxin, and many investigators have observed the loss of apical dominance and increases in lateral bud breaks in stems following treatment with this chemical.

Since the sweetpotato slip or sprout arises from adventitious buds on a structure that is morphologically a root (9), one should need relatively high concentrations of maleic hydrazide to retard proximal dominance on this root and still higher concentrations to completely inhibit bud development (7, 8). Simons and Scott (5) have reported a significant increase in the total number of sprouts produced by bedded Porto Rico sweetpotato roots that had been sprayed 6, 4, and 2 wk before harvest with maleic hydrazide at 500 and 2500 ppm. These same investigators also reported a distortion of the stem and leaves of the sprouts similar in appearance to the effects produced by 2,4-D in plants.

A similar reaction of sweetpotatoes to maleic hydrazide occurred in the present study. Relatively low concentrations of maleic hydrazide (1000 to 4000 ppm) induced a distortion of the stem and leaves similar to the one described in the preceding paragraph and, in some instances, reduced proximal dominance over the entire sweetpotato root. The foregoing two phenomena did not always occur together, nor did either one or both occur on all of the treated roots. Relatively high concentrations of maleic hydrazide (8000 to 16,000 ppm), on the other hand, increased the severity of this 2,4-D-like injury and gave a highly significant reduction in the total number of sprouts produced per root (Table 1).

Sprout inhibitions and reduced proximal dominance

similar to that described in the preceding paragraph have been obtained with preharvest foliage sprays of maleic hydrazide on a fall crop of sweetpotatoes in 1953. Further studies are currently being conducted on slip production and the storage behavior of these treated roots.

References

1. E. J. Kennedy and Ora Smith, *Proc. Am. Soc. Hort. Sci.* **61**, 395 (1953).
2. E. R. Marshall and Ora Smith, *Botan. Gaz.* **112**, 329 (1951).
3. D. B. Paterson, et al., *Plant Physiol.* **27**, 135 (1952).
4. S. H. Wittwer, et al., *Plant Physiol.* **25**, 539 (1950).
5. H. M. Simons and L. E. Scott, *Proc. Am. Soc. Hort. Sci.* **59**, 426 (1952).
6. R. Michael and P. G. Smith, *Proc. Am. Soc. Hort. Sci.* **59**, 414 (1952).
7. K. V. Thimann, *Am. J. Botany* **24**, 407 (1937).
8. A. C. Leopold and W. H. Klein, *Physiol. Plantarum* **5**, 19 (1952).
9. H. E. Hayward, *The Structure of Economic Plants*. (Macmillan, New York, 1948), pp. 485-513.

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A New Technique for the Study of Avian Chromosomes¹

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The study of avian chromosomes presents considerable difficulty because of the large number of small units lying in close proximity to one another. In the case of avian hybrids (1-3), there is an additional impediment; the use of embryos or testes for cytological material reduces even further the small yield of specimens obtained from individual matings. Furthermore, in some instances it might be desirable to be able to study the chromosomes of individual adult hybrids or other phenotypically interesting birds without the necessity of sacrificing them. The new techniques circumvent this difficulty by making available for study the chromosomes of growing feathers.

Pin-feather technique. It is well known that the most actively proliferating region of a growing feather is in the proximal epithelium at the base of the feather shaft, the so-called collar. Serial sections of a pin feather or of a growing feather whose tip has already emerged from the sheath also reveal some mitotic configurations in the proximal part of the feather pulp. The latter are fewer in number but larger in size than those in the collar.

By slitting the feather sheath, it is a simple matter to remove collar or pulp tissue under a dissecting microscope. Aceto-orcein squash preparations can then be made in the usual manner. The tissue may be prefixed with Carnoy's fixative (glacial acetic acid and absolute alcohol in a ratio of 1:3). Only small pieces should be used, and it is best to avoid any of the tough feather sheath.

¹A considerable part of this work was done while I was a graduate student in the Department of Anatomy at Stanford University. I acknowledge my indebtedness to members of that department and, particularly, to Professor C. H. Danforth for his friendly and helpful counsel.



FIG. 1. Chromosomes of a cell in metaphase from a pin feather of a golden pheasant hen. Top left, photomicrograph. Top right, camera lucida drawing of the same cell. Bottom, serial alignment of major elements.

Preculturing technique. It has been found that a brief culturing of growing feather tissue in a hypotonic balanced salt solution results in a marked separation of the chromosomes. This procedure seems to result in an increase in the number of dividing cells, particularly of cells in late prophase. This increase is probably caused by an inhibition or slowing down of cells in metaphase and anaphase, as shown by the work of Hsu and Pomerat (4), who studied the chromosomes of mammalian material in hypotonic media (4, 5). The addition of paradichlorobenzene to the salt solution appears to enhance the spreading effect, as previously noted for guayule and numerous other plants by Meyer (6).

In actual practice, the procedure has been as follows. Holtfreter's solution is saturated with *p*-dichlorobenzene and filtered, then diluted to half strength with distilled water and heated to 41°C. Air or oxygen bubbles are passed through the medium while culturing. The latter process has been found to improve the resulting preparation, probably by supplying sufficient oxygen and by increasing the diffusion of toxic waste products through the stirring action of the rising bubbles. The temperature can be held constant by the use of a water bath.

Tissue is prepared for culturing in the following manner. The sheath of a freshly plucked pin feather is slit lengthwise for a distance of $\frac{1}{2}$ to 1 cm. With a clean scalpel, the proximal millimeter or two of the feather base is gently scraped off the feather sheath and placed in the culture medium.

After culturing for 10 to 20 min, the material is transferred to a deep depression slide containing aceto-orcein, and is stained from 1 to 2 hr. Small pieces of this stained specimen can then be removed and prepared for examination.

In addition to the increased spreading of the chromosomes and the increase in the number of mitotic configurations, the chromosomes appear to be shorter and thicker. Stainability is probably somewhat reduced but not seriously so. The majority of dividing cells appear to be in late prophase. Although the prophase chromosomes are typically rod-shaped, the primary constrictions of the larger ones are clearly evi-

dent. A number of excellent metaphase configurations also can be found. These are generally better for study than cells in prophase, because in the latter the chromosomes are spread apart to such an extent that those of adjacent cells often overlap.

The chromosomes of a cell in metaphase from a pin feather of a golden pheasant hen are shown in Fig. 1. The tissue had been cultured for 10 min and was examined as a fresh aceto-orcein squash preparation. A Leitz apochromatic oil-immersion objective (80 \times N. A. 1.4) was used. The photograph suggests the presence of a helix in some of the chromosomes, due probably to the fixation.

The technique is definitely usable and will, undoubtedly, be improved by further experimentation. It is to be hoped that these methods will facilitate an elucidation of the cytogenetic affinities of recent avian species.

References

1. C. H. Danforth and Gunnar Sandnes. *J. Heredity* **30**, 537 (1939).
2. C. H. Danforth. *Evolution* **4**, 301 (1950).
3. Gunnar C. Sandnes. Ph.D. Dissertation, Stanford Univ., 1952.
4. T. C. Hsu and C. M. Pomerat. *J. Heredity* **44**, 23 (1953).
5. T. C. Hsu and C. M. Pomerat. *J. Morphol.* **93**, 301 (1953).
6. J. R. Meyer. *Stain Technol.* **20**, 121 (1945).

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The Appearance of Starch Grains of Potato Tubers of Plants Grown Under Constant Light and Temperature Conditions

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The external markings of the starch grain have been described as "striations" (1), "lamellae" (2), "striations" (3), "laminations or rings" (4), "lamellae or layered" (5), "striations or lamellations" (6), "layerings" (7), and "layers and laminations" (8).

Van de Sande-Bakhuyzen (4) was the first to ascribe these markings to the effect of external conditions. He noted that when the external conditions, illumination and temperature, are constant, "lamination" of wheat starch grains did not occur. Statements found by the writers which claim that these markings are absent in starch grains of plants growing under constant conditions of light and temperature refer only to the work of Van de Sande-Bakhuyzen (4).

For this study, Dr. John M. Arthur, of Boyce Thompson Institute of Plant Research, kindly offered to grow plants of the Katahdin variety of potato in a Constant Condition Light Room. These plants were under an AH-9 G.E. 3000-w lamp, which burned continuously from November 12, 1952 to June 3, 1953. The light intensity at soil level (about 42 in. from the lamp) was 450 ft-candles, as measured by a General Electric light meter. At a distance of 24 in. from the lamp tube, the meter reading was 650 ft-candles of 0.15 gram-cal/cm² min, as measured by a General



FIG. 1. Photomicrograph (400 \times) of typical starch grains of tubers of potato plants grown under conditions of constant light and temperature.

Electric radiation meter. The air temperature was $63^{\circ} \pm 2^{\circ}\text{F}$. The humidity was not controlled. The same variety of potato was grown under the varying light and temperature conditions of out-of-doors in northern Maine during the summer of 1952.

It was not possible to duplicate the "conditions" of the experiment as performed by Van de Sande-Bakhuyzen (4), since he notes that the temperature was "kept as constant as possible" but does not give figures for the range of temperature. He also states that "the temperature decreased for periods of 2 hr and $2\frac{1}{2}$ hr during the time of the experiment 7° and 5°C , respectively." Regarding the light, he writes "under constant illumination by Mazda C lamps." Since no distance is given, it was not possible to ascertain the amount of illumination received by the plants.

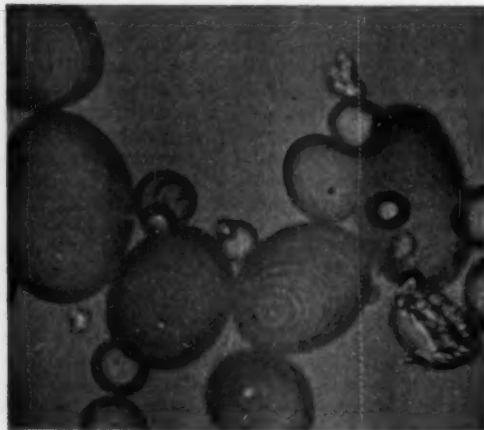


FIG. 2. Photomicrograph (400 \times) of typical starch grains of tubers of potato plants grown in Maine under field conditions.

Approximately 1000 starch grains from the tubers of plants grown under the controlled conditions of light and temperature and a like number from those grown under uncontrolled conditions out-of-doors in Maine were examined. In all instances, the "lamellations" or "layerings" were present. Previous examinations of the starch grains of potatoes grown out-of-doors at Yonkers, N. Y., were similar in appearance.

Starch grains formed in potato tubers of plants grown under a constant light source and a temperature of $63^{\circ} \pm 2^{\circ}\text{F}$ showed lamellation superficially indistinguishable from starch grains formed in tubers grown under normal field conditions.

Figures 1 and 2 are typical photomicrographs.

References

1. C. Nägeli and C. Cramer, *Pflanzen physiologische untersuchungen*, Vol. II, *Die Stärkekörner* (1858), pp. 298-405.
2. C. Nägeli, *Botan. Zeit.* **39**, 633 (1881).
3. A. Meyer, *Untersuchungen über die Stärkekörner* (Jena, 1895).
4. H. L. Van de Sande-Bakhuyzen, *Proc. Soc. Exp. Biol. Med.* **23**, 302 (1926).
5. E. C. Miller, *Plant Physiology* (McGraw-Hill, New York, ed. 2, 1938).
6. R. W. Kerr, *Chemistry and Industry of Starch* (Academic Press, New York, 1950).
7. J. Bonner and A. W. Galston, *Principles of Plant Physiology* (W. H. Freeman, San Francisco, 1952).
8. A. Frey-Wyssling, *Submicroscopic Morphology of Protoplasm* (Elsevier, Amsterdam, ed. 2, 1953).

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Glucuronic Acid Conjugates of Aspartic and Glutamic Acids in Urine¹

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It is known that amino acids are excreted in the urine in both free and combined forms. Woodson, *et al.* (1) found that only 1 percent of the aspartic acid and 10 percent of the glutamic acid of urine were present in the free state. Whereas peptide combinations may account for some of the bound amino acids in urine, conjugates of various other kinds are also present (1).

Although conjugation with glucuronic acid is one of the major detoxifying mechanisms in various species, glucuronic acid is also conjugated with certain normal metabolic products—for example, steroids. We present evidence here that aspartic and glutamic acids occur in urine, at least in part, as glucuronic acid conjugates.

One-hundred-milliliter portions of urine were dried as far as possible in vacuum on a water bath at 56°C .

¹ This work was aided in part by a grant from the American Cancer Society on the recommendation of the Committee on Growth of the National Research Council.

² From a thesis submitted to the faculty of the University of Tennessee in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

³ We wish to express our appreciation to T. P. Nash, Jr., and Gordon C. Mills for their valuable suggestions and advice and to acknowledge the able technical assistance of Bryan G. Mordecai. Appreciation is extended to the Rohm and Haas Co. for their contribution of the various ion-exchange resins used.

The remainder of the water was removed by azeotropic distillation with ethylene dichloride under vacuum (2). A dry but gummy residue (I) was obtained which was exceedingly hygroscopic. While still in the drying flask, residue I was extracted twice, for 1 hr each time, with 50-ml portions of 0.2N dl-camphorsulfonic acid (CSA) in dry acetone (3, 4).

The extracts (II) containing amino acids and their derivatives possessing free amino groups were decanted from the insoluble components of residue I, and the amino compounds were precipitated by the addition of triethylamine. The supernatant fluid, which retained the triethylamine salt of CSA (5), was decanted and the precipitate was washed several times with fresh dry acetone. Residual acetone was removed in vacuum, leaving a dry stable powder (III).

Tests on fraction III were strongly positive for glucuronic acid, both with naphthoresorcinol (6) and with the more specific carbazole reaction (7).

Fraction III was dissolved in 100 ml of water and passed through an ion-exchange column (IR-4B, Rohm and Haas), which was prepared by the method of Sanger and Tuppy (8). The column was then washed with deionized water until the washings were negative to ninhydrin, thus indicating that the column was freed of unadsorbed compounds.

The column adsorbate was eluted with 0.1M sodium tetraborate or citrate until the naphthoresorcinol test indicated that the elution of the glucuronic acid conjugates was complete (9). The total eluate was evaporated to dryness in vacuum and extracted with diethyl ether to remove interfering substances. Residual ether was removed by evacuation and the remaining solids (IV) were extracted with absolute ethanol. Two fractions were thus obtained, one ethanol soluble (V) and the other ethanol insoluble (VI). Examination of these two fractions by ascension chromatography failed to reveal the presence of free amino acids or free glucuronic acid. However, development of the chromatograms with aniline hydrogen phthalate and alkaline potassium permanganate (10) disclosed a reducing substance.

Portions of fractions V and VI were made 1N with respect to HCl and were hydrolyzed by autoclaving at a pressure of 10 lb/in.² for 4 hr. The hydrolysates were evaporated to dryness, redissolved in water, and reevaporated. The process was repeated several times to remove residual HCl. Paper chromatography, as well as microbiological assay procedures, established the presence of glutamic acid with only traces of aspartic acid in the ethanol-soluble fraction, whereas by the same techniques aspartic acid was found mainly in the ethanol-insoluble fraction VI.

In preparing dry urine solids (I), there is the possibility that conditions used may have produced the combination of glucuronic acid with glutamic or aspartic acid. However, a portion of lyophilized urine yielded results identical with those obtained on the product from the azeotropic distillation.

The results indicate the presence of a heretofore unreported type of conjugate in urine. Experiments to establish proof of structure, as well as to determine the amounts excreted, are in progress.

References and Notes

1. H. W. Woodson, R. W. Hier, T. D. Solomon, and O. Bergelm, *J. Biol. Chem.* **173**, 613 (1948).
2. E. Levin and F. Lerman, *J. Am. Oil Chemists' Soc.* **28**, 441 (1951).
3. E. V. McCollum and A. A. Rider, *Arch. Biochem. and Biophysics* **40**, 20 (1952).
4. E. V. McCollum, A. A. Rider, and H. Sass, *Proc. Soc. Exptl. Biol. Med.* **72**, 709 (1949).
5. Our experience does not confirm the reports (3, 4) that the ammonium salt of CSA, obtained by utilizing dry ammonia gas as the precipitating agent, is soluble in acetone. However, we have found that the presence of urea has some solubilizing effect on the ammonium CSA salt. Also, use of CSA with protein hydrolysates gives rise to a solubilized ammonium CSA salt.
6. B. Tollens and F. Rorive, *Ber. deut. chem. Ges.* **41**, 1783 (1908).
7. Z. Dische, *J. Biol. Chem.* **167**, 189 (1947).
8. F. Sanger and H. Tuppy, *Biochem. J.* **49**, 469 (1951).
9. It was found that the glutamic acid conjugate was present in greatest concentration in the eluate below pH 7 and the aspartic acid conjugate primarily in the eluate above pH 7.
10. R. J. Block, R. LeStrange, and G. Zweig, *Paper Chromatography* (Academic Press, New York, 1952).

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Communications

The Broken Spectre

In your issue of January 29 [*Science* **119**, 164 (1954)], there is a letter from Donald M. Black regarding "The Broken Spectre of the Desert View Watch Tower, Grand Canyon, Arizona." Mr. Black is evidently under the impression that this phenomenon, commonly called a "glory," is seen very infrequently. In fact, it has become a very usual observation since flying above the clouds became common. All that is required is that the aircraft be between the sun and a cloud and that the observer can see the shadow on the cloud. The aircraft itself is unnecessary except as a carrier of the observer, since the

phenomenon is backward scattering from the water droplets in the cloud and really surrounds the line from the sun through the observer's eye.

In the older literature that deals with atmospheric phenomena, the glory is not explained theoretically, but an attempt at an explanation is given by H. C. van de Hulst under the title, "A theory of the anticoronae" [*J. Opt. Soc. Am.* **37**, 16 (1947)]. No definite experimental verification of this theory has been made, but it seems probable that it is correct.

I have taken some small-scale color photographs from an aircraft over the ocean, but a complete check could be made only from an extensive program of

photography, including observations of the polarization of the radiation. A knowledge of the droplet size in the cloud would also be necessary.

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Received February 10, 1954.

An Inexpensive Inoculation Chamber¹

Plant tissue culturists working in sterile or aseptic atmospheres often do not need large areas in which to work. A small, portable chamber will usually suffice to prevent microorganism contamination to their culture containers. For this purpose, a small transfer cabinet was constructed simply and inexpensively. As can be seen from Fig. 1, it consists of plywood backs and sides and lucite top and hinged, slanting panel.

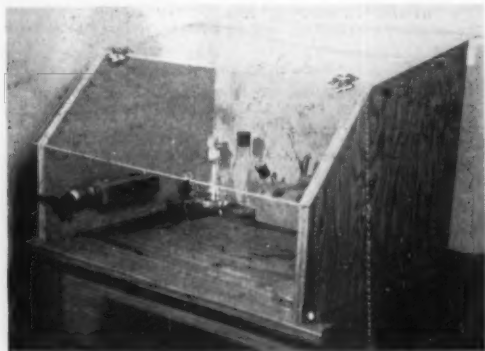


Fig. 1. Portable inoculation chamber.

Provision is made for a small light and necessary materials and working implements; if desired, an ultraviolet lamp may be placed on the back or top near the rear of the chamber. In the case cited, a Vycor No. 830-A, 16-in. ultraviolet lamp is used, attached to the plywood back, just below the lucite top (not shown in Fig. 1).

The cabinet has proved successful in everyday work, both from the standpoint of convenience and aseptic protection. It can be easily moved and adapted to any work area.

More details on the construction and dimensions are given in *Turtox News* (Apr. 1954).

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¹ The investigation in which this cabinet is involved is being supported jointly by research grants-in-aid from the American Cancer Society upon recommendation of the Committee on Growth of the National Research Council, and the National Cancer Institute of the National Institutes of Health, U.S. Public Health Service.

Geology of the Bedford Shale and Berea Sandstone in the Appalachian Basin

The Berea sandstone of early Mississippian age has been an important source of oil and gas in the Appalachian Basin for many years. This formation and the underlying Bedford shale are exposed at the surface in a long, narrow belt extending from northern Kentucky northward to Berea, Ohio, then eastward into Pennsylvania. From their outcrop, these beds dip east and south under the surface in eastern Ohio, western Pennsylvania, West Virginia, and eastern Kentucky. A study of the Bedford shale and the Berea sandstone at the outcrop and in the records of many thousands of wells drilled to these formations in the search for oil and gas has been completed recently by the U.S. Geological Survey, and the results are now being processed for publication. This study provides an understanding of the paleogeography of the region at the time the rocks were deposited.

In early Bedford time the region was flooded by a shallow arm of an epicontinental sea. This sea arm—the Ohio Bay—covered parts of Ohio, western Pennsylvania, western West Virginia, and eastern Kentucky and was bounded on the west by the Cincinnati arch, on the north by uplands in Ontario, and on the east and southeast by the low-lying Catskill delta of Devonian age.

From the upland in Ontario a vast river, the Ontario, carried sediments that were mainly red into the northern end of the Ohio Bay and deposited them on a delta that built southward. The sediments deposited above water in the main body of this delta retained their red color; those deposited under water were bleached to gray. Along the delta shores waves winnowed the sediments, removed the fine muds, and left the silts in offshore bars. One of these bars, in southern Ohio, is about 80 mi long and 6 mi wide. As the delta built southward, streams carrying mud and silt meandered slowly back and forth across the northern part of the delta and many channels became filled with mud and silt. By late Bedford time, the delta extended southward into northern Kentucky.

At the close of Bedford time, the areas to the north of Ohio Bay in Ontario and to the east in Pennsylvania and West Virginia were unwarped. The Ontario River cut rapidly and deeply into the northern part of the delta and abandoned the southern part by breaking out of the main channel and cutting south-eastward. The sea soon encroached on the southern part of the delta.

In early Berea time, a vast quantity of fine sand was carried into northern Ohio by the Ontario River and deposited in the deep scour channels cut in the northern part of the delta in late Bedford time. These stream channels apparently were filled rapidly by this influx of sand and abandoned, for quarries at Berea and Amherst, Ohio, have quarried stone from these sand-filled channels that lie in Bedford shale, yet few fragments of shale are found within the quarry stone.

On the eastern side of the Ohio Bay, in West Vir-

ginia, streams brought in sand and silt from eastern and southeastern sources. For a brief time a shore line was established in western West Virginia, and bars formed along the shore near the mouths of the rivers. Marine beds, mainly silt and very fine sand, were deposited to the west in eastern Kentucky.

By middle Berea time, downwarp in eastern West Virginia depressed the eastern Ohio Bay area, and the sea transgressed the shallow river channels that had been scoured in early Berea time.

Near the end of Berea time, the lands around the Ohio Bay sank slightly and the sea encroached, covering the Berea delta in northern Ohio and the sand-filled stream courses in central West Virginia. By the close of Berea time, the transgressing sea had spread the reworked sand and silt into a broad, thin sheet that is nearly continuous from northern Ohio to southeastern West Virginia.

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Received March 23, 1954.

Crystalline Regions in Metamict Minerals

A vexing problem in mineralogy is the nature of the metamict state [A. Pabst, *Am. Mineralogist* 37, 137 (1952)]. When certain minerals are subjected to emanations from radioactive elements, disorder in their structures results. Under prolonged or intense bombardment, damage to the original structure may be so great that the original structure cannot be directly determined by present x-ray or optical techniques.

In considering the problem, it seemed reasonable to expect that, even though damage is so great that the areas of relict crystal structure are too small and widely separated to be resolved optically or to give a meaningful x-ray diffraction pattern, they are large enough to be characterized by selected-area electron-diffraction patterns.

To test this hypothesis, samples of zireons from Ceylon and Oklahoma were examined. From each zireon two portions of material were selected—one was only weakly birefringent and gave a diffuse x-ray pattern, and the other was optically anisotropic and gave a sharp x-ray pattern. In every case, both portions gave sharp electron-diffraction patterns that were essentially identical.

These preliminary studies indicate that the electron-diffraction method is a powerful tool for the investigation of the physical nature of the metamict state and for the identification of metamict phases. Detailed investigations in this field are being continued.

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Received March 23, 1954.

Geophysical Surveys in Salt Lake Valley, Utah

A few years ago while the point-to-point aeromagnetic profile was being recorded, as is customary on all cross-country flights of the U.S. Geological Survey aircraft, an anomaly was discovered in the Salt Lake Valley between the Park City-Little Cottonwood and the Bingham mining districts. Later an aeromagnetic survey with 1-mi spacing was made of the northern Oquirrh Range and the southern part of the Salt Lake Valley to determine the magnetic characteristics of the Bingham stocks, to map the anomaly discovered in the valley, and to investigate the possibility that it might represent an intrusive mass similar to the Bingham and Little Cottonwood stocks.

The resulting aeromagnetic map showed one large elliptical anomaly with its long axis east-west in the Bingham Canyon area. The high point was over the south edge of the Utah Copper stock, the southernmost of the Bingham stocks, where it is in contact with the Oquirrh formation. The anomaly was obviously related to the intrusions, and the displacement of the anomaly maximum from the center could be attributed to the greater concentration of magnetic minerals produced by the mineralization and contact metamorphism of the stock. In Salt Lake Valley, low magnetic gradients were observed in general, with the exception of the elongate high over the southern part, which may be an extension of the Bingham Canyon anomaly. This elongate high is north of and parallel to the Traverse Mountains from their intersection with the Oquirrh Range to the Lone Peak salient of the Wasatch Mountains; it lies over an area covered by valley fill. Within this elongate high are several closes of still greater magnitude. The most prominent, which is approximately 3 mi southwest of Draper, is comparable in magnitude and extent to the anomaly over the Bingham stocks. Depth estimates indicate the source of the anomaly to be near the surface.

In August and September 1953, a vertical intensity magnetic survey was made of an area of 5 mi² in the Jordan River valley south of Salt Lake City to provide more detailed information on the source of two of the prominent aeromagnetic anomalies, including the one near Draper. A gravity survey was also made to provide supplementary information to aid in the interpretation. The area in which the survey was made is entirely covered by alluvium, and there is no direct geologic evidence available on possible sources of these anomalies.

The vertical intensity magnetic map shows two magnetic highs, one sharp and the other broad, corresponding except in intensity to the aeromagnetic anomalies. A positive gravity anomaly superimposed on a strong regional trend was found in approximately the same location as the sharp magnetic anomaly, which corresponds to the previously mentioned Draper anomaly. Attention was concentrated on this anomaly, and the depth of the disturbing body

was determined from the vertical intensity data as about 500 ft.

The anomalies due to geometric bodies of different sizes and shapes were computed, using solid-angle formulas, and it was found that anomalies resulting from a vertical cylinder of infinite depth extent with a radius of 500 ft, depth of burial of 400 ft, magnetic susceptibility of $12,350 \times 10^{-6}$ egs units, and a density contrast of 0.25 most closely approximated the observed anomalies. Rock of dioritic or slightly more mafic composition but with about 4 percent magnetite enclosed in limestone or quartzite would have this susceptibility and density contrast. Since rocks of similar composition have been found in the area, postulation of such a body is reasonable. The near-circular pattern and lower northern gradient of the Draper anomaly indicate that the source is a stock-like intrusion with a northward dip rather than a local occurrence of mafic extrusive rock. The depth of burial determined is an approximation, since the body was assumed to be vertically polarized, but is not more than 1000 ft and is probably less than 500 ft.

If the source of the anomaly is an intrusion, mineralization and contact metamorphism similar to those observed elsewhere in the Salt Lake Valley may be associated with it. To determine this, additional geophysical work and/or drilling will be necessary.

KENNETH G. BOOKS

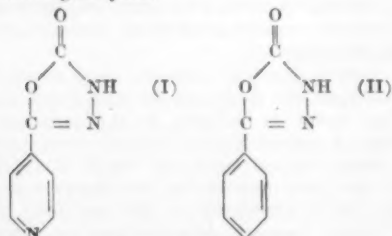
U.S. Geological Survey
Washington 25, D.C.

Received March 23, 1954.

The Action of Phosgene on Acid Hydrazides to Give 1,3,4-Oxiazolones of Interest in the Treatment of Tuberculosis

FREUND and KUH (1) have described the action of phosgene under pressure and at raised temperatures on certain phenylhydrazides to give small yields of *N*⁴-phenyl substituted 1,3,4-oxiazolones. Dornow and Bruncken (2) describe a similar reaction in which certain acid and diacid hydrazides yield 1,3,4-oxiazolones on treatment in aqueous acid solution at room temperature with phosgene [see Lieser and Nischk (3)].

On treating isonicotinic acid hydrazide at room temperature in an inert solvent or in aqueous acids, such as hydrochloric acid, with phosgene, the corresponding 1,3,4-oxiazolone (I) mp 265° C (decomposition) is formed in good yield.



2-Pyridyl-(4)-1,3,4-oxiazolone-(5)

The reaction is apparently general for this type of acid hydrazide. Benzhydrazide reacts for example, with phosgene (3) to give 2-phenyl-1,3,4-oxiazolone mp 138° C (II).

(I) is, as would be expected, soluble in aqueous acids and alkalis while (II) is, of course, soluble only in alkali. (I) on prolonged hydrolysis with concentrated hydrochloric acid yields practically quantitatively isonicotinic acid, hydrazine, and carbon dioxide.

(I) showed on *in vitro* tests slightly less activity against *M. tuberculosis* than isonicotinic acid hydrazide. *In vivo* tests in the guinea pig infected with strain H 37 Rv showed it to be, however, somewhat more active than isonicotinic acid hydrazide, both when assessed by weight-gain curves and histological examination of the various organs. The LD₅₀ (subcutaneous) of (I) was approximately one-tenth that of isonicotinic acid hydrazide when determined in the mouse and one-third that of isonicotinic acid hydrazide in the rabbit (*per os*). Chronic dosing of (I) in 4 times the therapeutic dose in the guinea pig during 2 mo showed favorable weight-gain curves and no pathological changes in any organ. Chronic toxicity tests (*per os*) in the rabbit using 10 times the therapeutic dose showed no pathological changes.

(I) and certain derivatives (4) are at present undergoing clinical trial. Certain derivatives of (I) show a high degree of *in vitro* activity against isonicotinic acid hydrazide resistant strains on *M. tuberculosis*.

A. E. WILDER SMITH

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References and Notes

1. M. Freund and F. Kuh, *Ber.* **23**, 2821 (1890).
2. A. Dornow and K. Bruncken, *Ber.* **82**, 121 (1949).
3. Th. Lieser and G. Nischk, *Ber.* **82**, 527 (1949).
4. Patents applied for.

Received February 10, 1954.

A Constituent of Human Perspiration with Intense Ultraviolet Absorption

GOLDRING, Hawes, Hare, Beckman, and Stickney (1) have reported the presence of a substance in human perspiration with intense ultraviolet absorption, capable of affecting absorbance readings if transferred to cell contents or surfaces. We wish to confirm the existence of this material for both men and women, and to describe a number of characteristics observed in a preliminary study.

Extraction experiments on small areas of skin indicated that the substance is taken up insignificantly by hydrocarbon or chlorinated solvents, to some extent by ethanol and methanol, and extremely well by water and alkaline solutions. Relatively large amounts can be collected by rinsing down the body surface with water, especially after a period of strenuous physical activity.

The rinse water, clarified by filtration through an

asbestos pad, shows characteristic ultraviolet absorption; the character of this absorption does not change on evaporation of the water under reduced pressure. The aqueous solubility of the absorbing material is so high that, although saline crystals separate out at a few milliliters volume, virtually the entire absorptive fraction remains in solution.

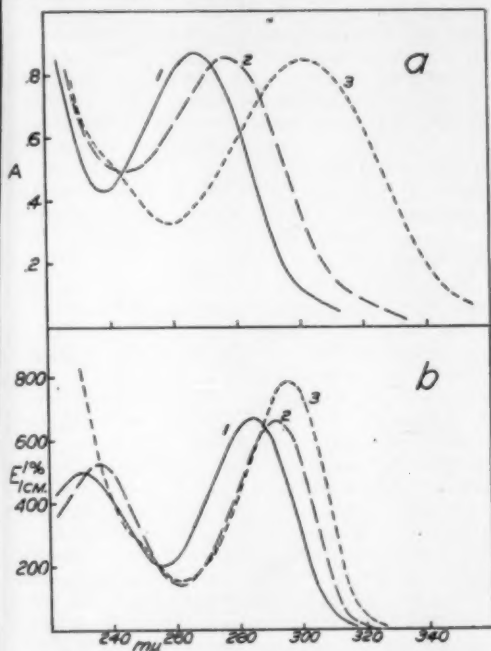


FIG. 1. Ultraviolet absorption spectra of: (a) the absorbing substances in human perspiration: 1, in 0.1 N HCl; 2, at pH 11; 3, in 0.1 N NaOH; and (b) uric acid: 1, in 0.1 N HCl; 2, at pH 7; 3, in 0.1 N NaOH.

It is relatively stable, as demonstrated by the fact that the characteristic absorption was unchanged after several weeks of standing in normal acid and alkali, and after an additional hour on the steam bath. Apparently no hydrolysis occurred during the acid treatment, since on extraction with butanol, there was no transfer of absorption to the solvent layer. It is not distillable with steam. Attempts to separate a clean fraction of the absorbing material by solution of the concentrate in ethanol followed by addition of hydrocarbon solvent were not successful. Chromatographic treatment was also unavailing; eluates from several columns gave little improvement or poor recovery. The absorption curves of a typical concentrate determined at pH values chosen to show its three characteristic spectrum species are given in Fig. 1a.

Of the water-soluble constituents reported for human perspiration (2, 3), including uric acid, ethereal phenol sulfates, and traces of amino acids, vitamins, and skatol, only uric acid (Fig. 1b) would seem to

possess absorption of the type and stability of that observed. The spectrum similarity is not particularly convincing, in view of the differences in wavelength of the bands and response to changes in pH. However, conjugation of the absorbing moiety with a saccharide, which may be assumed from its high water solubility, could be expected to cause some changes in absorption and ionizing tendencies. A Murexide test gave equivocal results.

The intense absorption and extreme solubility of this component of human perspiration serves to emphasize that, in ultraviolet spectrophotometry, care must be exercised to insure that no contact of the fingers with cell contents or surfaces shall occur.

Added in proof. It has just been called to our attention that Zenisek and Kral [*Biochim. et Biophys. Acta* 12, 479 (1953)] have identified urocanic (imidazole-acrylic) acid in human sweat by experiments involving paper chromatography. The absorption wavelengths are similar to those of the concentrate above.

J. M. VANDENBELT
C. E. CHILDS
DENISE LUNDQUEST
JERE SALADONIS

The Research Laboratories
Parke, Davis & Company
Detroit, Michigan

References

1. GOLDBRING, L. S., et al. *Anal. Chem.* 25, 869 (1953).
2. HOWELL, W. H. *A Textbook of Physiology*. XIV ed., p. 875. Philadelphia: Saunders, 1940.
3. MICKELSEN, O., and KEYS, A. J. *Biol. Chem.* 149, 479 (1943).

Received January 5, 1954.

Origin of the Compositional Variation of the Lavas of Parícutin Volcano, Mexico

Lava erupting continuously from Parícutin volcano during the period from February 1943 to March 1952 showed a progressive change of composition from 55 percent silica in the olivine-bearing basaltic andesite erupted in 1943 to slightly more than 60 percent silica in the orthopyroxene andesite erupted in 1952. The variation was gradual and surprisingly smooth except for a rapid decrease in magnesia and a rise in silica in 1947, which reflected a rapid decrease in modal olivine. The serial variation of the oxide constituents is that of the calc-alkalic igneous suite and conforms closely to the silica-variation diagram of the Parícutin region as a whole. The 22 analyzed lavas of Parícutin volcano, all from a single magma chamber and, no doubt, developed by the same process or processes, furnish an exceptionally favorable set of data for exploring the adequacy of the processes that might account for the igneous rock diversification in this petrographic province.

It is found from graphical tests on the Parícutin silica-variation diagram that selective removal or introduction of olivine, pyroxene, plagioclase, and mag-

netite, singly or in combination (that is, fractional crystallization), cannot account for the observed chemical changes in the lava series. The compositions assumed for the isomorphous minerals include generous ranges on either side of those inferred from optical measurements, yet the graphical tests show that no reasonable combination of added or subtracted representatives of the intratelluric minerals could yield oxide trends satisfactorily near those of the lava series itself. When, however, xenolithic material is included as one of the variables in the graphical tests with olivine and plagioclase, a remarkably good conformance of test trends to actual trends is obtained, and it is concluded that such a reasonable combination of bulk assimilation and fractional crystallization could have produced the chemical characters of the series.

Energy from the heat of crystallization of the particular mass of magma being contaminated would be entirely inadequate to accomplish the amount of assimilation implied by the graphical results. But an abundant supply of heat would be furnished by incremental crystallization of a magma that was circulating by thermal convection in a cupola above a major basaltic magma body, as suggested by S. Holmes [*Geol. Mag.* 68, 241 (1931)] and, in fact, several lines of evidence make it appear likely that the roots of the young volcanoes of the Parícutin region are cupolas rather than laccolithic masses. The Parícutin eruption is visualized as sampling the more contaminated magma of the upper part of a cupola through a tap that perhaps is offset somewhat from the apex of the cupola to provide a pressure-storage arrangement and account for the unusually steady and prolonged eruption.

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Received March 23, 1954.

Six-Minute Responsiveness Test to Insulin

In 1935, H. P. Himsworth, of London, found that diabetic individuals could be classed as being either sensitive (responsive) to insulin or insensitive to the hormone. From a practical viewpoint, such classification would have greatly facilitated establishing a correct rationale concerning treatment in a given patient. Unfortunately, workers in the U.S.A. and Canada were unable to confirm Himsworth's findings, presumably, it now appears, because unlike European commercial insulin, the insulins available in this hemisphere are not free of the hyperglycemic-glycogenolytic "glucagon" factor. The presence of glucagon seriously interferes with the efficiency of a responsiveness test to insulin.

Using a glucagon-free insulin, the writer and his group at The Brooklyn Hospital were able to substantiate the findings of Himsworth in 100 unselected diabetic patients. After a small dose (3 units) of

such insulin by vein, blood-glucose determinations (venous) were made after 2, 4, and 6 min. The resulting glucose curves served to array most of these diabetic individuals in the two distinctive categories propounded by Himsworth. Moreover, serial curves during the course of treatment of the diabetes demonstrated the fact that the patients who were originally unresponsive or poorly responsive to the insulin could in many instances by adequate treatment of the diabetes be reverted to normal responsiveness to the hormone. The 6-min test, accordingly, furnishes a much better yardstick for clinical improvement in the patient than do casual blood-glucose determinations. Casual blood-glucose readings may actually have been reduced to normal by massive dosage of insulin from without rather than as a result of improvement in the individual's own intrinsic efficiency in utilizing insulin. The test adequately makes this differentiation.

An extended study in 50 nondiabetic persons suggests that a most useful aspect of the test will be that of indicating which members of a diabetic family are destined ultimately to become clinical diabetics. Some of the obese individuals in the study, in spite of normal glucose-tolerance tests and normal casual blood-glucose readings, registered in the 6-min test a lack of responsiveness to glucagon-free insulin. This resistance to insulin in certain obese human beings correlates rather well with Mayer's findings of extreme insulin resistance in hereditary obese mice. It is reasonable to conjecture that such persistent defective response to insulin must result in a decreased insulin-efficiency and an increased production-demand on the body for insulin. In the presence of the well-recognized supernormal demands for insulin production already imposed by the obesity alone, such strained production-demand would be expected ultimately to result in "bankruptcy" of the intrinsic insulin-producing mechanism.

The work of Bornstein, Evelyn Anderson, and others suggests that the obese individual who develops diabetes usually suffers predominantly from a "relative" insufficiency of insulin rather than from an intrinsic inability of the organism to produce insulin. This deficiency is relative to exorbitant demands for insulin which the body cannot adequately meet. Whereas many diabetics give an antecedent history of obesity, only strikingly few of the large number of nondiabetic obese individuals actually do develop diabetes, despite their well-established increased demand for insulin. It would, accordingly, be of clinical importance to learn just which of these nondiabetic obese individuals show defective inability to respond to insulin and this well before clinical diabetes develops. The 6-min test furnishes one clue in this direction.

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Received March 17, 1954.

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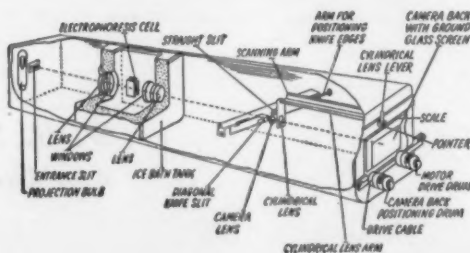
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The Gordon Research Conferences, AAAS

THE research conferences now known as the Gordon Research Conferences were organized by Neil E. Gordon at the Johns Hopkins University in the summer of 1931. The success in developing these conferences resulted from faith in ideas and faith in people. It was the belief that scientific men and women would profit by knowing one another better and by having an opportunity to discuss their scientific interests in a leisurely and informal manner amid pleasant surroundings.

The first conference was attended by about 25 faculty members and students of the University. The history of the first conference was not recorded in detail because of the informal character of the organization. It is known that in 1932 one conference was held on the subject of X-rays and Crystal Structure. The first summer proved that the basic principles from which the conferences were organized were sound, and the conferences continued each summer at Johns Hopkins University for the next 2 years.

In 1935, it was decided to hold the conferences at Gibson Island, Maryland, on Chesapeake Bay. The program consisted of three conferences: the Chemistry of the Aliphatic Free Radicals, Long Chain Molecules, and Vitamins. The following year the conferences were again held at Gibson Island and five subjects were covered. After Dr. Gordon resigned from Johns Hopkins, the University carried on the Seventh Annual Research Conference at Virginia Beach, Va., in 1937. Subsequently, a meeting was also held at Rehoboth Beach, Del. In 1938, the conferences returned to Gibson Island, and for the next 9 years they continued to increase in number and demand.

In 1946, the AAAS appointed a Management Committee to study the future of the conferences and to recommend definite plans for the continuation of what has proved to be one of the outstanding developments in science. The Committee consisted of George Calin-

gaert, chairman, Dean Burk, L. H. Flett, K. C. Hickman, and Sereck Fox. This Committee in 1947 decided to move the conferences from Gibson Island, where the summer atmospheric conditions were not too satisfactory, to Colby Junior College in New London, N. H. By this time, the number of conferences had increased to 10. In 1948, it was decided to organize 11 weekly conferences during the period from June 15 to Labor Day. The demand on the Management Committee for additional summer conferences continually increased, until in the summer of 1950 a second location for conferences was selected at the New Hampton School in New Hampton, N. H. In 1950, six conferences were organized. The following year 11 conferences were held at the New Hampton location. During the summer of 1953, 24 conferences were held, 12 at each location attended by 2466 scientists. The total requests for attendance has always exceeded the maximum permissible number.

In 1954, history will be repeated. A third location is necessary to attempt to satisfy the demand. Kimball Union Academy in Meriden, N. H., has been selected for the third series of seven conferences. The complete program appears elsewhere in this issue.

The Gordon Research Conferences were a natural development from a small beginning. The general pattern of scientific value has been established. They are highly regarded by scientists throughout the world. Inquiries and requests for information on the organization and operation of the conferences have been received from individuals who desire to organize similar meetings in other areas of science. It is believed that these conferences provide opportunities for the advancement of science that are not available at any other type of meeting.

W. GEORGE PARKS
Director

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University of Rhode Island, Kingston

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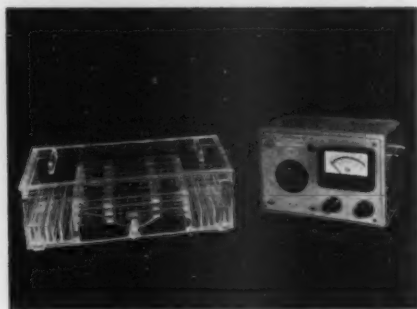
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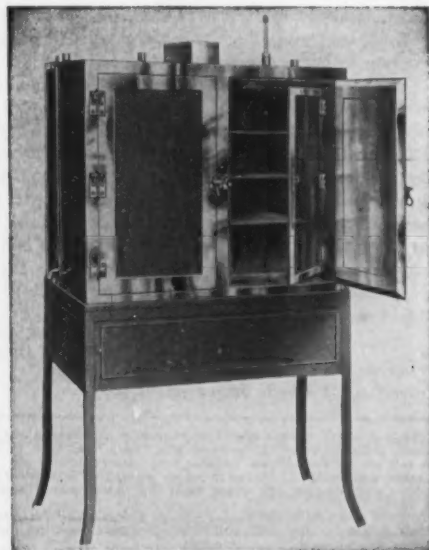
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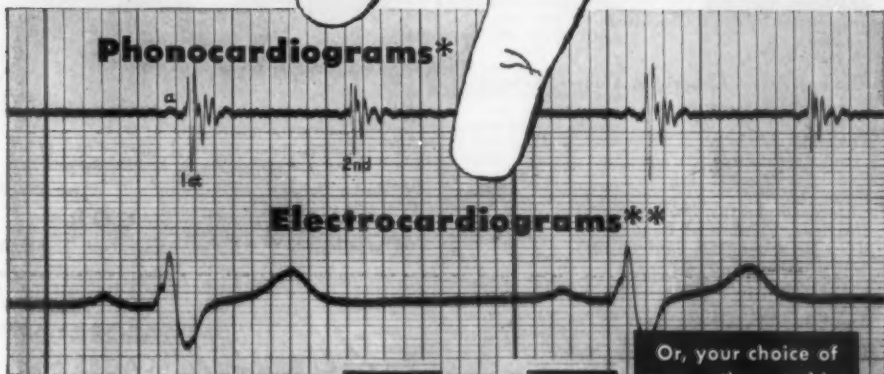
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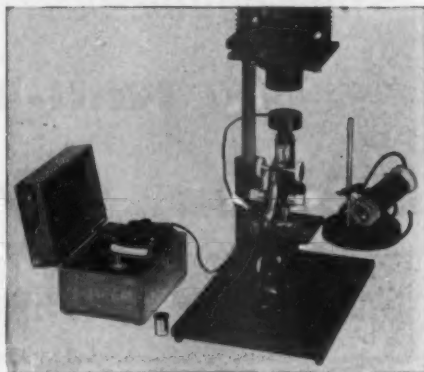


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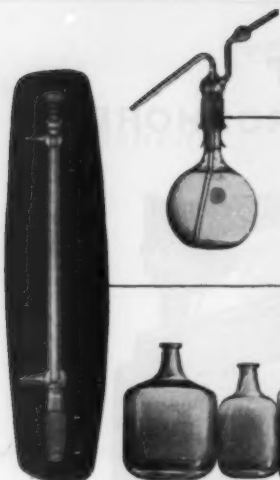
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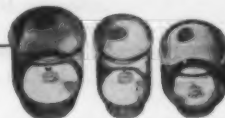
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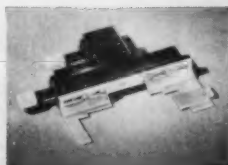
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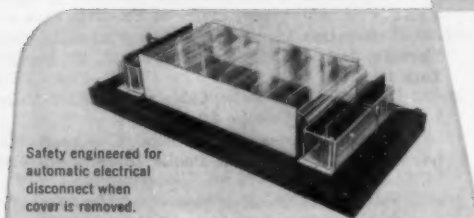
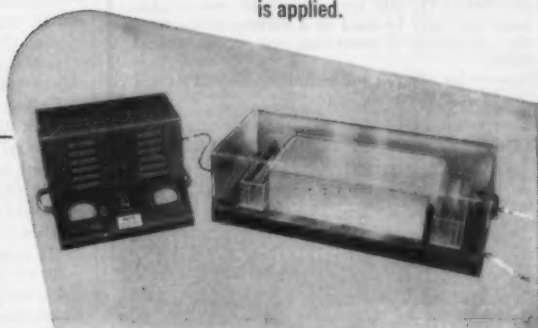
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May

- 8-9. Population Assoc. of America, annual, Charlottesville, Va. (H. Carter, National Office of Vital Statistics, Dept. of Health, Education, and Welfare, Washington 25, D.C.)
- 9-14. National Conf. of Social Work, 81st annual, Atlantic City, N.J. (Office, 22 W. Gay St., Columbus 15, Ohio.)
- 10-12. IRE National Conf. on Airborne Electronics, Dayton, Ohio. (H. Pratt, 800 Quaint Acres Dr., Silver Spring, Md.)
- 10-12. Symposium on Fluorides, Cincinnati, Ohio. (Sec., Inst. of Industrial Health, Eden and Bethesda Aves., Cincinnati 19.)
- 13-15. National Science Fair, 5th, Lafayette, Ind. (Science Clubs of America, 1719 N St., NW, Washington 6, D.C.)
- 14-16. American Acad. of Dental Medicine, 8th annual, Philadelphia, Pa. (W. M. Greenhut, 124 E. 84 St., New York 28.)
14. Maryland Acad. of Science, Baltimore, Md. (T. King, Pratt Library Bldg., Baltimore 1.)
- 14-22. Chemical Engineering and Equipment Exhibition, Frankfurt, Germany. (Dr. Brotschneider, Rheingau-Allee 25, Frankfurt.)
- 14-7. Cong. on Scientific and Technical Progress, 1st, Strasbourg, France. (L. Chereau, 29 Rue Serpente, Paris 6, France.)
- 16-19. American Inst. of Chemical Engineers, Springfield, Mass. (F. J. Antwerpen, 120 E. 41 St., New York 17.)
- 16-23. International Inst. of Welding, annual, closed, Florence, Italy. (J. S. Magrath, 33 W. 39 St., New York 18.)
- 17-20. Electronic Parts Show, Chicago, Ill. (K. C. Prince, 1 N. La Salle St., Chicago 2.)
- 17-20. Special Libraries Assoc., annual, Cincinnati, Ohio. (A. O. Hanson, Cleveland Public Library, Cleveland 14, Ohio.)
- 17-21. National Tuberculosis Assoc. and American Trudeau Soc., Atlantic City, N.J. (E. Lovell, NTA, 1790 Broadway, New York 19.)
- 17-22. International Dairy Federation, annual, Paris, France. (General Sec., 154 Rue Belliard, Brussels, Belgium.)
- 17-24. International Office of Epizootics, 22nd, Paris, France. (Sec., 12 Rue de Prony, Paris 17.)
- 18-21. American Planning and Civic Assoc., annual, Columbus, Ohio. (Miss Harlean James, 901 Union Trust Bldg., Washington 5, D.C.)
- 19-22. International Cong. of Athletic Medicine, Belgrade, Yugoslavia. (Dr. Smolaka, Deligradska 27, Belgrade.)
- 21-26. American Assoc. for the Advancement of Science, Pacific Division, Pullman, Wash. (R. C. Miller, California Acad. of Science, Golden Gate Park, San Francisco 18.)
- 21-22. International Soc. of Surgery, Paris, France. (L. Dejardin, 141 Rue Belliard, Brussels, Belgium.)
- 21-22. Operations Research Soc., 2nd annual, Chicago, Ill. (T. E. Caywood, 203 N. Wabash Ave., Chicago 1.)
- 24-26. National Telemetering Conf., Chicago, Ill. (W. J. Mayo-Wells, Applied Physics Laboratory, Silver Spring, Md.)

Meetings & Conferences

May, contd.

- 24-27. Symposium on Instrumentation for Industrial Hygiene, Ann Arbor, Mich. (Director, Continued Education, School of Public Health, Univ. of Michigan, Ann Arbor.)
- 24-28. American Assoc. of Cereal Chemists, annual, Denver, Colo. (C. L. Brooke, Merck & Co., Rahway, N.J.)
- 29-5. International Ornithological Cong., 11th, Basel, Switzerland. (Jardin Zoologique, Basel.)
- 29-6. International Medico-Surgical Reunion, 2nd, Turin, Italy. (A. M. Dogliotti, Palazzo delle Esposizioni al Valentino, Turin.)
- 30-2. International Anatomical Nomenclature Committee, London, Eng. (T. B. Johnston, Guy's Hospital, London, SE 1.)
- 30-6. International Cong. of Agricultural and Food Industries, 10th, Madrid, Spain. (Sec., 3, Zurbane, Madrid.)

June

- 1-2. International Neurologic Reunion, 19th, Paris, France. (J. Sigwald, 68, Boulevard de Courcelles, Paris 17.)
- 6-11. Conf. on Industrial Research, Harriman, N.Y. (R. T. Livingston, 409 Engineering Bldg., Columbia Univ., New York 27.)
- 7-10. National Plastics Exposition and Technical Conf., Cleveland, Ohio. (Soc. of Plastics Industry, 295 Madison Ave., New York 17.)
- 7-12. International Cong. of Psychology, 14th, Montreal, Can. (H. S. Langfeld, Eno Hall, Princeton Univ., Princeton, N.J.)
- 8-10. National Soc. of Professional Engineers, annual, Milwaukee, Wis. (P. H. Robbins, 1121 15 St. NW, Washington 5, D.C.)
- 9-12. American Soc. for Quality Control, 8th, St. Louis, Mo. (D. Shainin, 70 E. 45 St., New York.)
- 11-17. Pan American Assoc. of Ophthalmology, 3rd, São Paulo, Brazil. (M. E. Alvaro, Consolacao 1151, São Paulo.)
- 14-16. American Neurologic Assoc., 79th annual, Atlantic City, N.J. (H. H. Merritt, 710 W. 168 St., New York 32.)
- 14-16. American Soc. of Agronomy, Corn Belt Branch, annual, Lincoln, Neb. (E. J. Frolík, Dept. of Agronomy, Univ. of Nebraska, Lincoln 3.)
- 14-18. American Soc. for Engineering Education, annual, Urbana, Ill. (A. B. Bronwell, Northwestern Univ., Evanston, Ill.)
- 14-18. American Soc. for Testing Materials, annual, Chicago, Ill. (R. J. Painter, 1916 Race St., Philadelphia 3, Pa.)
- 14-18. Symposium on Molecular Structure and Spectroscopy, annual, Columbus, Ohio. (H. H. Nielsen, Dept. of Physics, Ohio State Univ., Columbus 10.)
- 14-19. American Soc. of Civil Engineers, Atlantic City, N.J. (D. P. Reynolds, 33 W. 39 St., New York 18.)
- 14-19. Cong. and Exhibition of l'Aluminium Français and La Société Chimique de France, Paris, France. (R. Gadeau, 23 Rue Balzac, Paris 8.)
- 15-18. Medical Library Assoc., Washington, D.C. (Col. F. B. Rogers, Armed Forces Medical Library, Washington 25.)

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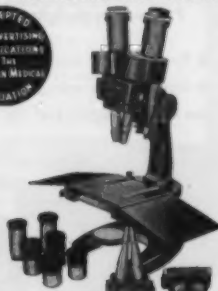
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Meetings & Conferences

June, contd.

- 16-18. Symposium on Solution of Electrolytes, New Haven, Conn. (R. T. Gucker, Jr., Dept. of Chemistry, Indiana Univ., Bloomington.)
- 16-19. Colloquium of College Physicists, annual, Iowa City, Iowa. (G. W. Stewart, Dept. of Physics, State Univ. of Iowa, Iowa City.)
- 17-19. The Endocrine Soc., Sir Francis Drake Hotel, San Francisco, Calif.
- 18-19. American Rheumatism Assoc., annual, San Francisco, Calif. (W. H. Kammerer, 33 E. 61 St., New York 21.)
- 18-20. American Soc. for the Study of Sterility, Sir Francis Drake Hotel, San Francisco, Calif.
- 18-22. Canadian Medical Assoc., Vancouver, Can. (General Sec., 135 St. Clair Ave., West, Toronto 5.)
- 19-20. Soc. for Investigative Dermatology, San Francisco, Calif. (H. Beerman, 255 S. 17 St., Philadelphia 3, Pa.)
- 20-23. American Astronomical Soc., Ann Arbor, Mich. (C. M. Huffer, Washburn Observatory, Madison 6, Wis.)
- 20-23. American Soc. of Agricultural Engineers, annual, Minneapolis, Minn. (F. B. Lanham, ASAE, St. Joseph, Mich.)
- 20-24. American Soc. of Medical Technologists, Miami Beach, Fla. (R. Matthaei, Suite 25, Hermann Professional Bldg., Houston 25, Tex.)
- 20-25. American Inst. of Chemical Engineers, Ann Arbor, Mich. (D. L. Katz, Dept. of Chemical Engineering, Univ. of Michigan, Ann Arbor.)
- 20-25. American Soc. of Mechanical Engineers, semiannual, Pittsburgh, Pa. (C. E. Davies, 29 W. 39 St., New York.)
- 20-25. International Meeting on Chemical Engineering Aspects of Nuclear Processes, Ann Arbor, Mich. (D. L. Katz, Dept. of Chemical Engineering, Univ. of Michigan, Ann Arbor.)
- 20-26. American Library Assoc., annual, Minneapolis, Minn. (D. H. Clift, 50 E. Huron St., Chicago 11, Ill.)
- 20-10. National Training Laboratory in Group Development, Bethel, Me. (L. P. Bradford, 1201 16 St. NW, Washington 6, D.C.)
- 21-23. Chemical Inst. of Canada, 37th annual, Toronto, Can. (D. W. Emmerson, 18 Rideau St., Ottawa 2.)
- 21-25. Alpha Chi Sigma Fraternity, annual, East Lansing, Mich. (J. R. Kuebler, 5503 E. Washington St., Indianapolis 19, Ind.)
- 21-25. American Inst. of Electrical Engineers, summer general and Pacific general, Los Angeles, Calif. (H. H. Henline, 33 W. 39 St., New York 18.)
- 21-25. Symposium on Impact of Solid State Science on Engineering Materials, Pittsburgh, Pa. (J. W. Graham, Jr., College of Engineering, Carnegie Inst. of Technology, Pittsburgh 13.)
- 21-25. Technical Writers' Inst., 2nd annual, Troy, N.Y. (J. R. Gould, Rensselaer Polytechnic Inst., Troy.)
- 21-25. American Medical Assoc., annual, San Francisco, Calif. (AMA Office, 535 N. Dearborn St., Chicago 10.)
- 22-24. American Dairy Science Assoc., 49th annual, State College, Pa. (J. O. Almquist, College of Agriculture, Pennsylvania State Univ., State College.)
- 22-24. Oceanographic Convocation, Woods Hole, Mass. (H. R. Gault, National Research Council, Washington 25, D.C.)
- 22-25. Rubber Technology Conf., 3rd, London, Eng. (Sec., Institution of Rubber Industry, 12, Whitehall, London, SW 1.)

Meetings & Conferences

June, contd.

- 23-25. Cong. for the Advancement of Spectrographic Methods, 17th, Paris, France. (Sec., G.A.M.S., 1, Place St. Thomas d'Aquin, Paris 7.)
- 23-26. Acoustical Soc. of America, 25th, New York, N.Y. (W. Waterfall, 57 E. 55 St., New York 22.)
- 25-29. Inst. of Aeronautical Sciences, New York, N.Y. (S. P. Johnston, 2 E. 64 St., New York.)
- 27-1. Inst. of Food Technologists, annual, Los Angeles, Calif. (C. S. Lawrence, 176 W. Adams St., Chicago 3, Ill.)
- 28-29. National Science Teachers Assoc., New York N.Y. (R. H. Carleton, 1201 16 St. NW, Washington 6, D.C.)
- 28-30. American Assoc. of Physics Teachers, Minneapolis, Minn. (R. F. Paton, Univ. of Illinois, Urbana.)
- 28-30. American Physical Soc., Minneapolis, Minn. (K. K. Darrow, Columbia Univ., New York 27.)
- 28-30. American Soc. of Heating and Ventilating Engineers, 60th semiannual, Swampscott, Mass. (Sec., ASHVE, 62 Worth St., New York 13.)
- 28-2. European Cong. of Gastroenterology, 4th, Paris, France. (A. Busson, 63 bis Rue de Varenne, Paris 7.)
- 28-3. National Education Assoc., annual, New York, N.Y. (L. W. Ashby, 1201 16 St. NW, Washington, D.C.)
- 30-2. Heat Transfer and Fluid Mechanics Inst., Berkeley, Calif. (H. A. Johnson, Dept. of Mechanical Engineering, Univ. of California, Berkeley.)

July

- 1-9. British Medical Assoc., Glasgow, Scotland. (BMA, Tavistock Square, London, WC 1.)
- 2-8. International Cong. of Oto-Neuro-Ophthalmology, 19th, São Paulo, Brazil. (C. de Rezende, Hospital das Clinicas, Avenida Ademar de Barros, São Paulo.)
- 2-14. International Cong. of Botany, 8th, Paris, France. (P. Chouard, 11, Rue de Val-de-Grace, Paris 5.)
- 6-9. American Home Economics Assoc., San Francisco, Calif. (Miss M. Horton, 1600 20 St. NW, Washington, D.C.)
- 7-10. American Physical Soc., Seattle, Wash. (J. Kaplan, Univ. of California, Los Angeles.)
- 8-9. International Union of Pure and Applied Physics, 8th, London, Eng. (H. A. Barton, 57 E. 55 St., New York 22.)
- 8-12. Conv. on Industrial Electronics, Oxford, Eng. (Sec., Brit. I.R.E., 9 Bedford Sq., London, W.C.1.)
- 10-15. Latin American Cong. on Gynecology and Obstetrics, 2nd, São Paulo, Brazil. (J. Ramos, Av. Brigadeiro Luiz Antonio, 278-80, São Paulo.)
- 11-14. American Soc. of Refrigerating Engineers, Seattle, Wash. (M. C. Turpin, 234 5 Ave., New York 1.)
- 13-17. Conf. on Defects in Crystalline Solids, Bristol, Eng. (H. A. Barton, 57 E. 55 St., New York 22.)
- 13-17. Cong. on Experimental and Theoretical Nuclear Physics, Glasgow, Scotland. (H. A. Barton, 57 E. 55 St., New York 22.)
- 15-17. International Symposium on Solid Particles in Astronomical Objects, Liège, Belgium. (P. Th. Oosterhoff, Leiden Observatory, Leiden, Netherlands.)
- 15-21. Pan American Cong. of Child Welfare and Pediatrics, 4th, São Paulo, Brazil. (J. Ramos, Av. Brigadeiro Luiz Antonio 278-80, São Paulo.)

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Meetings & Conferences

July, *contd.*

- 16-21. International Conf. on Electron Microscopy, London, Eng. (F. W. Cuckow, Royal Cancer Hospital, London, SW 3.)
- 17-22. Latin American Cong. on Mental Health, 1st, São Paulo, Brazil. (A. C. Pacheco e Silva, Av. Brigadeiro Luiz Antonio 278-80, São Paulo.)
- 19-23. International Cong. of Gerontology, 3rd, London and Oxford, Eng. (Mrs. A. Humpage, Tavistock Square, London, WC 1.)
- 19-24. Pan American Cong. on Gastroenterology, 5th, São Paulo, Brazil. (J. Ramos, Av. Brigadeiro Luiz Antonio 278-80, São Paulo.)
- 20-24. International Conf. on Thrombosis and Embolism, Basel, Switzerland. (W. Merz, Gynecological Clinic, Univ. of Basel.)
- 21-24. International Cong. of Medical Psychotherapy, Zurich, Switzerland. (H. K. Fiers-Monnier, Hauptstrasse 8, Kreuzlingen, Switzerland.)
- 21-28. International Cong. of Crystallography, 3rd, Paris, France. (J. D. H. Donnay, Johns Hopkins Univ., Baltimore, Md.)
- 23-29. International Cancer Cong., 6th, São Paulo, Brazil. (H. L. Stewart, National Cancer Inst., Bethesda, Md.)
- 25-31. Inter-American Cong. of Sanitary Engineering, 4th, São Paulo, Brazil. (L. Nogueira, Caixa Postal 8099, São Paulo.)
- 26-31. International Cong. of Gynecology and Obstetrics, Geneva, Switzerland. (W. Geisendorf, Maternité, Hôpital Cantonal, Geneva.)
- 27-28. International Union of Theoretical and Applied Mechanics, 4th, Brussels, Belgium. (H. L. Dryden, 1724 F St. NW, Washington 25, D.C.)
- 28-2. International Union for the Protection of Nature, 4th, Copenhagen, Denmark. (H. J. Coolidge, National Research Council, Washington 25, D.C.)
- 28-2. Symposium on Photoelasticity and Photoplasticity, Brussels, Belgium. (H. L. Dryden, 1724 F St. NW, Washington 25, D.C.)

August

- 3-13. Pan American Federation of Engineering Societies, 3rd, São Paulo, Brazil. (H. Pegado, Edifício Maua, Viaduto Dona Paulina, São Paulo.)
- 9-27. Summer Seminar in Statistics, 5th, Storrs, Conn. (G. Beall, Dept. of Statistics, Univ. of Connecticut, Storrs.)
- 10-14. Canadian Teachers' Federation, annual, Vancouver, Canada. (G. G. Croskery, 444 Mac Laren St., Ottawa.)
- 12-14. International Cong. on Group Psychotherapy, 1st, Toronto, Can. (J. L. Moreno, 101 Park Ave., New York 17.)
- 13-14. International Cong. on Child Psychiatry, Toronto, Can. (A. Z. Barhash, 186 Clinton Ave., Newark 5, N.J.)
- 13-21. World Poultry Cong., 10th, Edinburgh, Scotland. (Cong. Sec., Dept. of Agriculture for Scotland, St. Andrew's House, Edinburgh 1.)
- 14-21. International Cong. on Mental Health, 5th, Toronto, Can. (J. D. Griffin, 111 St. George St., Toronto 6.)
- 15-28. Pan Indian Ocean Science Cong., Perth, Western Australia. (A. D. Ross, 31 Ventnor Ave., West Perth.)

TRAVEL ARRANGEMENTS FOR THE AAAS BERKELEY MEETING December 26-31, 1954

In time or in cost, a trip from an eastern city to California is not much more than a round trip to a midwestern city. Californians who for years have been attending meetings in the East have told their colleagues that the continental distance is the same each way, and that it should be the turn of the Easterners to visit the Pacific Coast.

The Association is planning ways it may assist those who will attend the 121st AAAS Meeting on the campus of the University of California at Berkeley, this December. The possibilities include:

1. Low cost AAAS limousines from Oakland and San Francisco airports and railroad terminals direct to the dormitory or hotel of each delegate.
2. Arrangements for traveling together in AAAS cars on fast trains leaving Chicago, Washington, D. C., and New York.
3. Arrangements for chartering first class DC6, 6B, or 7 planes of scheduled airlines—at prices comparable with air coach travel.

Note: In the following table of round-trip fares all figures include the new lowered 10% federal tax.

ROUND TRIPS TO OAKLAND OR SAN FRANCISCO FROM

	Chicago	Washington, D. C.	New York
By Bus	Time: 2½ days \$82.50	Time: 4 days \$104.94	Time: 4 days \$112.31
By Rail	Time: 2½ days — leaving evening, Dec. 24 and morning, Dec. 31	Time: 3½ days — leaving evening, Dec. 23 and morning Dec. 31	Time: 3½ days — leaving evening, Dec. 23 and morning Dec. 31
Reclining seat coach	\$ 99.17	\$147.62	\$156.64
First class	\$139.10	\$204.33	\$222.67
Lower berth	46.20	60.06	63.58
Total	\$185.30	\$264.39	\$286.25
By Air	Time: 7-8 hrs., leaving a.m. or p.m., Dec. 26; returning a.m. or p.m. Dec. 31	Time: 10-11 hrs., leaving a.m. or p.m., Dec. 26; returning a.m. or p.m., Dec. 31	Time: 10-11 hrs., leaving a.m. or p.m., Dec. 26; returning a.m. or p.m., Dec. 31
Air coach (no meals)	\$167.20	\$215.60	\$217.80
Chartered 1st class (meals included)	c. \$178.00	c. \$235.00	c. \$235.00
First class (meals included)	\$239.91	\$312.18	\$332.09

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1. ☐ Chicago ☐ Washington, D. C. ☐ New York ☐ Other city:

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- ☐ Rail — coach ☐ Air — coach ☐ Bus
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Zoologist: Invertebrates; Protozoology, Entomology, Parasitology; Taxonomy, Ecology; Teaching experience; June Ph.D.; Box 106, SCIENCE. X

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(a) Ph.D. in biochemistry with minor in organic chemistry; research involving isolation and purification of biologicals derived from natural sources; large industrial company; Chicago area. (b) Board internists with subspecialties in neurology, hematology, nutrition, endocrinology; important research posts; opportunity teaching, clinical work; \$12-\$15,000. (c) Immuno-chemist; medical school research laboratories; research predominantly on immunology of Hodgkin's disease; West. (d) Research; physician trained pharmacology; key post; important organ; opportunity teaching; \$15,000. (e) Pediatrician or Ph.D., research projects involving nutrition, cerebral palsy. (f) Clinical psychologist, Ph.D., to become associated with psychiatric group; South. S-4-3, Medical Bureau (Burnice Larson, Director) Palmolive Building, Chicago. X

Teaching Fellow—bachelor's degree in Biology, Botany, or Zoology; conduct laboratory sections in Elementary Biology; men's Liberal Arts college; \$2300; opportunity for study. Department of Biology, Bowdoin College, Brunswick, Maine. X

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